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EDITORIAL NOTES—GAS, &c.

Points from the Publicity Conference.

ALTHOUGH, in the interests of the freedom of speech, a conference such as that on the subject of the publicity scheme for the gas industry is not one for reporting in the customary manner, we were authorized by the Committee to indicate last week the general features of the debate; and to-day we have their sanction to publish the "Memorandum," signed by the President of the Institution (Mr. Alex. Wilson), and presented by Mr. F. W. Goodenough. There are points in the document which may be emphasized in the light of the discussion that ensued upon the submission of it. In the first place, it must be said that we were particularly gratified with the large and representative character of the conference—delegates attending from the company and municipally owned gas undertakings of England, Scotland, Ireland, and Wales. It was for the British gas industry a novel assembly. It is the first time that gas administrators, engineers, and secretaries have met together to discuss on a common platform a question of political importance to the industry; it is the first time that there has been any recognition, by such a gathering, of the community of industrial interests. We hope this is a good augury for the future in more senses than one, and that it is only the first of many times that, when occasion demands, there will be similar conference for the protection and advancement of mutual interests.

There is nothing but a feeling of satisfaction with the enthusiasm that generally pervaded the meeting. Frankly, we had anticipated that there would have been more doubt expressed as to the benefit of the scheme to individual concerns. But throughout the large meeting there were only one or two such expressions of opinion—opinion honestly stated, but opinion which had, it was felt, a sort of "icy "isolation" in, and was altogether out of harmony with, the gathering. The questions that were raised, with these one or two exceptions, were entirely upon matters of detail. Warmer sympathy with the scheme there could not have been; greater confidence in the promoters could not have been shown; more complete concord could not have been evinced as to the necessity for the development of public knowledge of the advancements made by gas. A central agency is urgently required to spread among the people the feeling that every gas undertaking is a commercial institution, and not a monopoly without a soul or any interest other than that of grabbing as much money as possible. A central agency is required to get gas talked about by all judicious means that men living in the industry can jointly devise, with talented assistance—a central agency to scatter the educational seed that will keep the country informed as to the economies and efficiencies to be realized by the application of never-ceasing improvement. There is hardly a house in existence in the country in which a more extended use of gas could not be made in displacing solid fuel and in the lightening of labour; there is hardly a house in which greater satisfaction could not be obtained by the installation of more modern burners. There is all this that the present individual propaganda work has not succeeded in touching; and meantime rivals are active. If every gas administrator, every gas man, would transfer himself outside of the success of the gas industry, and concentrate his mind for a few moments on the vast ignorance of gas affairs that exists in the public mind, he would not be a business man if he did not say "We must try some new means of removing "this ignorance." The publicity scheme is a business proposition. There is the ignorance of gas advances; there is the keen and not over-scrupulous competition. Hereon words of the "Memorandum" are pregnant with truth and common sense: "In these days of intensified competition, "intensive culture of his territory is recognized as essential "to success by every business man of repute. The full "development of the possibilities of any business can only "be achieved by the persistent, skilful, and convincing pre-"sentment to the public of the advantages they will derive "from the buying of the product that it is desired to sell; "and by vigilant and successful reply to attacks made upon "that product by those interested in competing goods."

From this publicity scheme all gas undertakings must benefit—not, perhaps, with any immediate recognizable tangibility; but the greater the enlightenment of the public mind, through those channels that will attract most, the greater will be the chance of business development, and the greater the resistance offered to business rivalry. Considering this, considering the community of interest there is in an industry such as this, and how influence (without any statutorily defined area) travels, surely no gas administration can with dignity refuse alliance with the movement. There is the point as to the position of municipalities owning both gas and electricity undertakings. We can see nothing anomalous in them joining in a movement for the development of the gas business through educational means. Surely they want to see the gas undertaking as well as the electricity undertaking prosper, and be of the greatest possible service to the community. When misstatement is made concerning the prime commodity of an industry that has been doing a public service for upwards of a century, no municipality, though possessing both gas and electricity undertakings, can object to correction—nothing more. We cannot conceive that any such municipality would desire to push the interests of their electricity undertaking by any but fair means. This scheme that they are asked to support, quoting the words of the "Memorandum," is "not a campaign against electricity, "but a campaign in favour of gas." When, however, gas is attacked, it must be defended. Among the manufacturers of gas appliances there is no question as to the wisdom of the movement. The Society of British Gas Industries had their line of delegates at the meeting. Their members sympathize with the movement, abundantly recognizing that their interests are inseparably bound up with those of the gas-supply industry. Casting our mind back to the conference of a week or so since, we cannot help feeling that it has done more to advance the spirit and influences of industrial combination and oneness than anything that has yet occurred in the whole industry. We are looking forward to the first material issue in a solid support for the project outlined in the "Memorandum" which appears elsewhere.

A Few Reflections on Details.

THERE was entire agreement at the conference that the time is fully ripe for a co-operative movement—and there is not an alternative better than this publicity one—for the maintenance and progress of the commercial interests of the gas industry. It seems almost unnecessary in these times to stay to discuss how much more can be done by co-operation than by any amount of individual endeavour in such a matter as this. Gas undertakings are not as competitors trying to out-do each other in the same area in respect of their prime commodity; and therefore the industry is eminently suitable for combined propaganda. Excepting the electricity industry, we know of no other that offers such scope for joint endeavour in this regard. The very best propaganda methods that can be fashioned and operated by one undertaking are also the very best for other undertakings under like conditions. The efforts of the Committee, it is proposed, shall be directed to putting the highest character into their work and productions, and yet vary them so that, in both, every undertaking may find what is required compatible with its own circumstances and environment. Instances were produced at the meeting as to how co-operation—a case in point is the Bournemouth and neighbouring Gas Companies—in the production of high-class, beautifully illustrated and printed literature, has

cheapened very substantially the cost to the undertakings that have already united themselves for the purpose. The "Memorandum" printed elsewhere indicates the lines of possible work in this connection far more broadly, and yet only in outline, than we have space for doing here. The best workers—artistic and literary—who possess the talent for catching the eye of the public and arresting their attention will be engaged. The more opulent of undertakings may be in a position to employ such as these in the preparation of their circulars, posters, magazine and newspaper articles, and advertisements; but a very large sum is involved in doing the work thoroughly well. Co-operation means a reduction of cost per undertaking, coupled with the enjoyment of the best fruits by all co-operating. For any one undertaking to individually aim at these is to squander money. The areas of gas undertakings do not overlap; and the same work, through the central agency, could be adapted and applied to many districts.

Another matter to which several references were made at the conference was that of advertising. The question was raised as to whether the articles and the advertisements will reach the people. We want to get the subject of gas uses more and more into the atmosphere; we want to have them talked about; and, given the means, the articles that will be published will appear in papers and periodicals that are read by all classes far and wide. Pamphlets and circulars are read by some, not by all; advertisements are read by some, not by all. But articles in a man's or a woman's favourite paper are generally perused, just as new posters at intervals must catch the eye of the pedestrian. "My constituency "is largely a working-class one," said one speaker at the meeting. The trains, the trams, the 'buses are thronged with working men going into that district from their labour to their homes day by day, and they buy a halfpenny evening paper. They read it; but they may not read the circular lying at home. The business man has his papers; and the ladies of the country theirs. "The basis of the Committee," said one speaker at the conference, "is comprehensive enough "to deal with the working classes." The basis is comprehensive enough to deal with all classes throughout the kingdom, if by co-operation (which means a comparatively light thing measured by volume of business) the Committee are put into the position to do the work well. Let it be remembered that knowledge gained by a person through his or her reading is not, as a rule, kept to himself or herself. He or she becomes, in turn, a distributing agent of the knowledge. "What is "the good of having advertisements and articles in general "papers?" asks the man who has had no experience of the advantage. The Gaslight and Coke Company reply that advertisements of the kind have brought to them inquiries from the districts of other gas companies, and even from abroad—from as far afield as the distant East. Every gas undertaking has a composite *clientèle;* every section of that *clientèle* must be catered for in the propaganda. But no one gas undertaking—the largest, much as they already do, are not accomplishing in publicity all they would like to do—can reach them all through the very multiplicity of the ways that are required to gain their ears and their eyes. It is a far-reaching propaganda system that is in view; and it can be carried out by full support. The extent of support must determine the limits of the propaganda. And every subscribing undertaking to this work will—the assurance was given at the conference—be properly represented in the matter of the administration of the funds.

The resolution passed at this large gathering was a mandate to the present Committee to prosecute their work in gaining the completest co-operation of British gas undertakings. There was only one question that they are going to further consider. It is that of contribution. At the conference, some considered there should be a graduated scale of contribution; some that the *pro rata* 2s. 6d. per million cubic feet of gas sold was too high; others thought it was not; while one speaker about hit the nail on the head when he said that the Committee had made a mistake in not asking for 5s. per million, as then the 2s. 6d. would have been readily conceded. If the Committee had asked for 0·03d. per 1000 cubic feet of gas sold, they would have easily obtained it; and yet the (shall we say) infinitesimal 0·03d. is the equal of 2s. 6d. per million! "Let us start in "a small way," says one adviser, "and see what are the "results." There was an almost inaudible "Hear, hear." "Let us jump" says another, "and make some impression." The remark was lustily cheered. "We are out for busi-"ness," says another, "and do not let us have any haggling "over such a small sum as 2s. 6d. per million cubic feet." This seemed to be the general feeling of the conference. Big results that will draw hereafter larger subscriptions cannot be obtained from going about the work in any mean-spirited way in the inceptive stage. The gas industry is an extensive thing with extensive interests; and we hope the whole industry will have regard to its dignity in this matter, and not be content with a position inferior to that occupied by the electricity industry in its publicity work.

As remarked at the commencement of this comment upon the proceedings at the conference, we are well satisfied with it from all points of view; and we believe its influence will be felt through the length and the breadth of the country. And now that the Committee have been formally authorized by such a representative gathering to push forward with the work of enrolling the subscribers, and organizing the publicity machinery and setting it in motion, we are hopeful of the spirit of the movement pervading the whole industry, and producing a support that will entitle those responsible to take the most energetic and effective action.

Westminster Lighting under Test.

It is with considerable gratification that we read the report that the City Engineer of Westminster (Mr. J. W. Bradley, M.Inst.C.E.) has made to the Works Committee of the Council upon the illumination of the arterial and other streets of the city (that come under the new lighting contract) by high and low pressure inverted gas-lamps. And it is a further gratification to know, from the report submitted to the Council a week ago by Mr. Lyon Thomson, that the Works Committee, in the absence of their Chairman (Mr. Jacques Abady, upon whom fell so much of the responsibility for piloting this improvement in street lighting through the Council), have expressed to the City Engineer their "appreciation of the satisfactory way in "which the installation of improved public gas lighting "in the streets of the city has been carried out;" while Mr. Bradley, on his part, has testified to the contract having been executed in a satisfactory manner. Upon the circumstance of such administrative and official recognition, we may heartily congratulate the Gaslight and Coke Company. In a few—very few—quarters, there were some misgivings as to whether the Company would be able to fulfil the conditions of the contract. Our electrical contemporaries worked themselves up into quite an unholy joy in prematurely contemplating the humiliation of the gas industry in general and the Gaslight and Coke Company in particular over the non-performance of the terms of the contract. As we said at the time, the Gaslight and Coke Company know their own business much more intimately than their electrical rivals; and we think outward silence may be construed to mean that the electrical people are now privately admitting this to be so, as well as regretting the foolishness of their own error. Others who were antagonistic to the scheme, through originally an incomplete knowledge of the modern progress of gas lighting, are now among those who extend their congratulations to all concerned on the large and brilliant demonstration, and the fulfilment, with substantial margin, of the terms of the contract.

Mr. Bradley has, under the conditions laid down in the contract, been testing the lamps of all kinds during the past three months; and, as will be observed from the report in our news columns, both the percentage and the total excess of light over the minimum required is considerable. Said the electricians only a few months ago, "3000-candle power "high-pressure gas-lamps! Impossible!" The tests of the lamps by Mr. Bradley show an average actual illuminating power of 3274 candles, giving a percentage margin over the minimum of 9·13. The 1800-candle power units give an average actual candle power of 2016, or an average percentage increase of 12. The low-pressure units are of equal interest in the matter of the excess over the minimum. The 300-candle power lamps supply an average illuminating power of 361 candles, or an average percentage increase over the minimum of 23·3. The 180-candle power units exhibit an average of 202 candles, or an average excess of 12·2 per cent. over the minimum. But the 90-candle power units can lay claim to 132 candles as the average actual illuminating power, or an average percentage increase over the minimum of 46·6. What have the former electrical critics to say to these figures, the results of tests not of a single evening, but extending over three winter months? In making their criticisms—if they can find any

to make—they must remember that the Company are supplying illumination, under a contract carrying penalties for any default in respect of the stipulated minimum per unit. It is important under such circumstances that critics should not commit the folly of deliberately running their heads against a brick wall. The proceeding is a little dangerous, and sometimes produces discomfort. However, the outcome of Mr. Bradley's tests is that a total excess illuminating power is shown over the specified minimum, of 142,393 candles. A further point of interest is that, based on the minimum candle power specified, the cost per candle power per annum of 3940 lighting hours is 4·24d.; but based on the present ascertained illumination, as measured at the specified angles, the cost for a lighting year of 3940 hours is 3·57 per candle power per annum. This is eminently satisfactory testimony.

A Novel Partnership for Holborn.

A position of affairs in connection with the Holborn public lighting contract has been reached that is not without its side of humour, although we must close our eyes to it, and treat the matter with all business seriousness. Our readers have been kept well informed regarding the proceedings associated with this public lighting contract—how the Gas Company made an offer for a new contract and the improvement of the street illumination at certain prices per lighting unit; how the Electricity Companies (with the Metropolitan Electric Company representing them) stepped in; how there was a lighting experiment in Gower Street between the rival illuminants; how inverted gas-burners of nearly 100-candle power less than the metallic filament lamps exhibited gave a better distribution of light; how the Electricity Companies submitted an offer, with the Gas Company's prices in their possession, that totalled to a figure less than that of the latter; how difficulties ensued; and how the Borough Council drew up a fresh scheme as a basis for contracts, and invited tenders from the rival parties. This was the point at which the matter stood at the time that the last report upon it appeared in our columns. What did the position that had been created mean for the Companies—Gas and Electric? Simply this, that to secure the contract there must be a cutting-down of prices that would result in a positive loss for the successful tenderer, more especially seeing that both parties would have had an immense amount of initial work to carry out in order to undertake the lighting of the whole borough in compliance with the terms of the specification. The situation was unquestionably an impossible one; yet both parties wanted the honour of carrying out the lighting of the district.

It is not known definitely to whom is due the conception of the brilliant idea that has ended in the stay of all competition for the street lighting of Holborn; but, whoever was the genius, his motto must be "*medio tutissimus ibis*." Representatives of the Gas Company and the Electricity Supply Companies met in conference, put their heads together, and evolved a joint scheme of gas and electric lighting for the streets of Holborn, on terms which were submitted (on the Gas Company's letter paper) to the Borough Council last week. Under the circumstances, the distributors of the means of lighting being no longer competitors but in alliance, they are in a position to submit conditions to the Council on which they are prepared to carry out the project. The Borough Council will no doubt feel that they have had the ground cut from under their feet, and that they are now in a corner, instead of the Gas Company being in one corner and the Electric Supply Companies in another. But if the Council will look at the matter from the points of view of the competitors, they must recognize the dilemma in which a peculiar course of events had driven them. Moreover, the Companies by their compact have not taken advantage of the Council in the matters of price and the illumination they are proposing to give. As will be seen from the statement in our news columns, the total price is lower than the Council have yet had before them; while the total illumination offered is higher. Where the Companies, under their agreement and combined offer, suggest modification is in asking for a contract for ten years, in the cancelling of the penalty clause (or its acceptance at an increase in the price equal to 10 per cent.), and in relief from any obligation to supply new burners, &c., resulting from improvement or advancement that may occur, unless the Council agree to bear the cost. These are fair stipulations. The whole tenor of the offer shows that the treaty has not been made with any intention to cause Holborn's purse to suffer, but solely, in the most honourable manner, to clear away the anomalous and insurmountable barricades that events had thrown across the Companies' respective paths. It is now for the Council to make the next move. They are not going to publicly say what that move will be, until they have thoroughly examined the position. The Works Committee are to consider the subject, and then the Council in private. It is a singular situation; but so far as exposed circumstances enable judgment to be formed, it is the best. It is hoped that the Council will so regard the matter.

London Gas Companies' Accounts for Last Year.

In another part of the "Journal" will be found our tabular statement of the accounts of the three London Gas Companies for the past year. It will be seen that the total capital, including premiums, engaged in the supply of gas on Dec. 31 last amounted to £40,158,151, compared with £38,424,921 at the close of 1909—an increase of £1,733,230. The total income was £7,170,207, against £6,733,207, or an increase of £437,000; and the expenditure £5,237,840, against £4,928,033, or £309,807 more. The gross profit was £1,932,368, compared with £1,805,174; being at the rate of £4 16s. 3d. per cent. on the capital, and £38 14s. 8d. per cent. on the total gas-rental. The latter figures for 1909 were £4 14s. and £37 12s. 5d. The second table, giving the results of working out the items in the preceding one on the basis of each 1000 cubic feet of gas sold, shows that the Gaslight and Coke Company stand the highest, and the South Metropolitan Gas Company the lowest, in the matter of capital outlay, income, and gross profit; but in expenditure the South Metropolitan Company stand the highest. Taking the mean of the three Companies, the figures are these: Capital, 19s. 7·82d.; income, 3s. 6·11d.; expenditure, 2s. 6·76d.; and profit, 11·35d.; those for 1909 being respectively 20s. 0·84d., 3s. 6·2d., 2s. 6·89d., and 11·31d.

The following table shows the carbonizing results of the three Companies, so far as they relate to the manufacture of gas from solid raw material only; and a noteworthy feature is the further increase in the quantity of gas produced in the case of each Company. The mean make per ton last year was 11,828 cubic feet, compared with 11,405 and 10,939 cubic feet in the two preceding years.

Table *showing the Residuals Produced and the Gas Made per Ton of Coal by the Metropolitan Gas Companies in the Year* 1910.

Name of Company.	Coke.	Breeze.	Tar.	Am. Liq.	Gas.
	Cwt.	Bushels.	Gallons.	Gallons.	Cub. Ft.
Gaslight and Coke .	12·70	4·35	9·73	34·48	11,732
South Metropolitan .	12·37	4·51	9·67	39·71	11,923
Commercial	12·25	4·87	11·71	37 76	12,179
Mean per Ton . .	12·55	4·44	9·83	36·55	11,828

Pay of Technical Assistants.

We hear much in these times about technical education and the application of science to our industries and businesses; and it is a subject this country cannot afford to allow to drop into oblivion. There is a Royal Commission in existence considering the future of University work in the Metropolis, with the view of making better provision for the training of students in the various branches of Applied Science. It is recognized that Leeds, Manchester, Birmingham, Liverpool, and other provincial cities are much better equipped than is the Metropolis in this respect. We have in London our colleges, schools, and polytechnics which are largely patronized by those seeking a technical and scientific training; but these are not the same thing as the universities that grace and are doing a good work in our northward cities. These universities are spreading their valuable operations from industry to industry; and their progressive work deserves every encouragement. The times demand greater culture and greater efficiency in the staffs and men of industrial enterprises. Higher efficiency means greater industrial protection. Even the commercial men in any branch of business, concerned, for instance, in engineering or mechanical apparatus or processes of any kind, have to know more to-day than ever before of the technical side of their work. If there is any negligence by them in this respect, they will soon be found out of the running. This is a view of the matter that was dilated upon, in a recent

article, by the Engineering Correspondent of the "Daily "Telegraph;" and it is a view the gas industry is realizing more and more. Perhaps the realization is slow in developing itself to proper proportions in some quarters; but still there is the fact that realization has made very considerable headway. No one who really knows what he is talking about will deny that, in both the technical and the commercial world of the gas industry, the most successful men are those who have an intimate acquaintance with the principles and the mechanism in detail of the apparatus and appliances with which they deal.

The juniors of the gas industry have recognized the necessity for enlarged qualification in its work of those in any official position; and it is a good thing for the future of the industry, and the protection and expansion of its resources, that this is so. But from statements that are heard from juniors at various times, and from the amounts of salaries that are offered in advertisements from time to time, one is very doubtful whether proper encouragement is always given to the technically trained members of the staffs on the works and on the district. We should like Directors and Gas Committees to look into this matter a little more closely, to ascertain whether their methods of compensating technically qualified juniors for their services are thoroughly sound in degree and in relation to other branches of the service. It would be a pity to unconsciously let discontent rule, when the adoption of a judicial and therefore judicious policy would alter the condition of things. There are the assistants on the works and on the district who must have technical qualification; there are also the draughtsmen and the chemists—men who have spent both time and money in specially qualifying themselves. There is, or should be, a considerable amount of ability among these members of the staff—at any rate, upon their work there rests a large amount of responsibility.

But their technical ability, qualifications, and responsibility are not always thoroughly recognized by a Board of Directors or a Committee. In fact, their technical ability, qualifications, and responsibility oftentimes do not place them in any superior financial position to the man who goes straight from school to the desk, and commences the routine and anything but brain-racking duties of a clerk—useful and necessary though the performance of those duties is. Frequently, too, it is found that mere length of service dominates the amplifying of reward, with this result, that members of the clerical staff, foremen, and storekeepers are in places found receiving more in pay than the technically trained assistants. Under such circumstances, what is the good of spending money and time in technical training, what is the good of aspiration and work directed to doing something on the higher planes of service, if as much recompense can be obtained in the clerical department, or by working for a position as foreman or storekeeper? Such men have much less responsibility than (say) the chemist whose testing work and other duties are largely the safeguard in working and purchasing the raw materials, or the draughtsman upon whose calculations and designs depend the safety of much expenditure. Far be it from us to say that length of service should not receive its due reward. That is not our point. What we are claiming for technical assistants and juniors is that their special ability and qualification should not be recompensed on a scale inferior to those whose comparatively routine work only calls for experience and care, and who have had to spend no years in acquiring special knowledge and skill such as have the technical assistants. They require encouragement and fair pay—pay superior to that of men who (we do not say this with any disrespect) are less accomplished so far as the work of a gas undertaking is concerned. The matter is worth thinking over in connection with the administrative methods (it may be doubted whether in some cases any method at all exists in this regard) of remunerating the members, technical and otherwise, of gas-works staffs.

Major Pringle's Report Under Examination.

A critical examination of the lighting portion of the report of Major Pringle, of the Board of Trade, on the Hawes railway disaster is made in an article appearing in another column; the writer treating of the question of lighting from the standpoint of a railway expert. We ourselves made an examination of the report on the 4th inst.; and it is a pleasure to find that what was then said harmonizes so considerably with the views of the writer of the article published to-day. It has already been acknowledged that, while Major Pringle presents a very friendly side to electric lighting for railway trains, he does not suffer from such purblind antagonism to the use of gas for this purpose as some other intemperate people. On the contrary, he has gone to a length in his report in speaking of the advantages that incandescent gas lighting possesses over electric lighting, and in showing how protection can be given to the carriage gas-cylinders, that form a substantial contradiction to his own opinion as to electricity being the preferable illuminant for this particular purpose. The writer of the article in our columns comments on certain of Major Pringle's recommendations, and makes further suggestions for his consideration. It is an important argument that is put forward as to the greater safety of coal gas than oil gas; and it is an important consideration, too, as to the relation that reliability of the lighting system has to public safety. This is essentially a question that must be considered in all its bearings. It seems to have been overlooked in the discussion that "the running of electric trains is ten times more dangerous on account of fire than all the train gas lighting in the kingdom." "Yet who complains?" What has happened in the case of such accidents? "Steps have been taken to do what is possible to minimize the danger." The question of lighting is one for the fullest practical consideration, and not for decision merely on the ground of a personal fancy, or in response to the clamour of hysterical and interested parties.

The Evidence and the Cause.

The "Electrician" is earning a reputation for notable discoveries, for saying curious things, for indulging in thin poetry (such as "The Gas-Stove of Adolphus Brown"), and for producing week by week a few feeble "ifs" and queries, in which there is an attempt at wit (such as "If the use of gas as an illuminant were made a criminal act!"). It may-be that our contemporary cannot help printing this sort of thing, in the effort to cater for the varied mental capacities of its readers. This week this organ of wit and light and leading fastens on us for venturing to state what was the truth—and it cannot deny it—that a defective electric ventilating-fan was the primary cause of the recent disaster at the Middlesbrough Music Hall. Our contemporary appears to make light of the occurrence, though there were two deaths and several people injured through the panic. This is what it says: "Now, apart from the fact that even the 'JOURNAL OF GAS LIGHTING' can scarcely expect a ventilating-fan to be driven by gas [there is already a gas-driven ventilating-fan on the market], just such a similar panic might have been caused in a variety of other ways—by a taxi-cab back-firing outside, or a gas mantle in the passage beginning to waggle on its crutch, for instance." The profound character of the argument is striking—and characteristic. But it happens that it was not a taxi-cab in the street, nor a waggling gas mantle in a passage, that was the primary cause of the disaster; but it was a defective electric ventilating-fan in a music hall where hundreds upon hundreds of people of all ages were assembled. Mr. H. M. Taylor, the Borough Electrical Engineer, at the inquest on the two little victims of the panic, said:

> He had the fan taken down, and inside the framework he found marks of the blades scraping. To that he attributed the stoppage of the fan. In the event of the stoppage and the current still being in the motor, the current would increase in quantity to such an extent that it would burn the cotton covering of the wires, and gradually increasing it would become sufficient to fuse the wires of the motor. The armatures of the fan were burnt out.

The Coroner (Mr. O. H. Cochrane) stated that the initial cause of the panic was "the sparking of the fan due to a latent defect in its construction." We have never heard of a music hall audience being panic-stricken by a taxi-cab back-firing in the street, nor through a gas mantle waggling; and we do not think a Middlesbrough audience would be affected by either—though there is, at any rate, one paper that submits it as being among the possibilities. But that paper is the "Electrician."

Renwick to the Rescue.

Then we did wrong in the eyes of our contemporary in stating that the American news correspondents of the British Daily Press had declared that the destructive disaster at the New York State Capitol was originated by the fusing of an electric wire. The report so upset the Electricity Publicity Committee that their energetic and wary mainspring (Mr. H. B. Renwick) cabled to the "responsible authorities," says one paper, and "reliable and authoritative

sources" says another, for information. It would be highly interesting to know who were the responsible, reliable, and authoritative authorities and sources, and whether "electrical" should not have preceded the "authorities" and the "sources." The reply received was that "there was *no* evidence whatever as to the cause of the fire." Just so! Where there is "no evidence" it looks very suspicious. However, it is "*conjectured* that the fire was due to the dropping of a lighted match by a careless smoker." That is the old-fashioned *dernier ressort* of our electrical friends. The lighted match and careless smoker have served the electricians so long and so faithfully that it is high time they were given a rest. But the "no evidence" and "conjecture" of Mr. Renwick's responsible, reliable, and authoritative, and let us add careful, correspondent do not by any means constitute a negation of the "fusing of an electric wire" report that emanated from American Press men, who are probably no more favourably disposed towards gas than to electricity.

Trade Union Law.

The question of whether the Osborne case decision is applicable to levies by Trade Unions for the purpose of paying the expenses of Labour representation on municipal and local bodies, and whether a member of a Trade Union could properly be expelled from the Society for refusing to pay such levies, has been before the Lancashire Chancery Court at Manchester. The plaintiff was a member of the Operative Bleachers', &c., Association, and the action was to restrain them from applying the funds of the Society to the purpose named, and to have a rule authorizing such levies declared void, as well as to restrain them from expelling him. The Society, which was never registered, was established in 1866; but it was not until 1903 that the rule objected to, authorizing levies for local Labour representation, was inserted. The plaintiff, William Smalley, had been a member of the Society for twenty years, and was entitled to considerable benefits for sickness, superannuation, and so on; but after this levy became payable, he refused to pay it, and was expelled from the Association. In the course of a considered judgment, Vice-Chancellor Leigh Clare remarked that no active objection seemed to have been taken to the new rule providing for a levy of sixpence a year for representation purposes until the Osborne case was finally decided. Then, however, the plaintiff and others determined to raise the question; and the matter was taken up by the Solicitor to the Trade Union Defence League. It was admitted that plaintiff was not given an opportunity of defending himself before he was expelled; and therefore the proceedings had not been in accordance with natural justice. Further, he was not expelled under any express rule authorizing expulsion. Without imputing to the Executive Committee that they acted dishonestly or maliciously, it was clear that they acted in a manner quite inconsistent with common ideas of fairness between man and man; and on this ground the expulsion must be declared void. As to the new rule regarding the levy, it appeared to him, quite apart from the Osborne judgment, that the plaintiff could not be bound to comply with this rule. Plaintiff was entitled to say that, having joined the Society when the objects did not include anything like that set forth in the new rule, it was not competent for the majority of the Society to impose burdens upon him other than those he had contracted to bear. He could not see any difference between parliamentary and municipal elections and representation. It had been argued that the Osborne decision on the main point did not apply to this case, as the Society was not registered; but looking at the fact that none of the judges had relied on the point that the Society in question was a registered as distinguished from an unregistered Association as a ground of their decision, he was unable to give any effect to it. The declaration he made in plaintiff's favour was (1) that the Trade Union were not entitled to levy or demand payment or collect moneys from the plaintiff, or to make payment out of their funds, for the purpose of Labour representation, either parliamentary or municipal; and (2) that the new rule was invalid and not binding upon the plaintiff.

The Accounts of Borough Councils.

There will be found on another page of this issue some figures extracted from Part V. of the Annual Local Taxation Returns; this being the one volume of a series of eight Blue-Books which is devoted to the accounts of Councils of Boroughs other than Metropolitan Boroughs. Some 250 foolscap pages are needed to set forth the particulars of the financial transactions of the 327 boroughs (exclusive of the Metropolis) during the year which came to an end on March 31, 1909. In considering the statistics, it will, of course, be borne in mind that they are now two years old; but in view of the great improvement in point of time of publication that has been made on the present occasion, we will not insist too much upon this fact. In looking at a Blue-Book of this description, perhaps the table that one is tempted to turn to first is that relating to outstanding loans. The total amount of money owing by the borough councils grows greater as each yearly volume of statistics appears; and at the end of 1908-9 the £250,000,000 figure had been passed. This compares with £246,500,000 the year before, and £232,000,000 in 1904-5. As a set-off against this, there is shown in the accounts now under notice an amount of about £16,500,000 standing to the credit of sinking, &c., funds, applicable to repayment of loans. Among the many purposes—some of the undertakings, of course, being of what is termed a "reproductive" character—to which the money represented by this outstanding indebtedness is attributable are the following: Tramways and light railways, £22,349,450; water-works, £61,405,122; gas supply, £19,284,887; electricity supply (including indistinguishable items for public electric lighting), £21,212,817; roads and streets, £27,957,827; sewerage and sewage disposal, £20,528,062; public lighting (other than indistinguishable items for public electric lighting), £83,650. With two exceptions—gas and public lighting—these all represent increases over the previous year. The amount of loans outstanding on account of education (£19,588,439) is nearly a million pounds more than was the case twelve months before. If consideration is given for a moment to the figures with regard to gas and electric lighting, it will be seen that while, following the usual custom, the outstanding loans on gas-works show a decrease (though on this occasion only a trifling one), as compared with the previous year, those on account of electric supply undertakings exhibit—also as usual—an increase of something in the neighbourhood of £500,000. Since 1904-5, the outstanding loans on gas have decreased by nearly £500,000; while those for electricity works have increased by little less than £2,500,000. The total rateable value of the boroughs in the period now dealt with was £75,317,035.

Relieving the Rates and Meeting Deficiencies.

Possibly, after the outstanding debt, the portion of the Blue-Book which will be found most generally interesting is that which contains tables relating to certain of the undertakings carried on by municipalities which are usually classed as "reproductive." These tables, among other things, contain columns showing respectively the "Sums transferred from other accounts of the councils to meet deficiencies in revenue," and the "Surplus revenue transferred to other accounts of the councils in relief of rates." The undertakings which are thus separately dealt with are tramways and light railways and gas, water, and electricity works; and in connection with such of these concerns as are in the hands of borough councils it is shown that, for the year 1908-9, there was a total sum transferred in relief of rates of £937,051. This is about £115,000 less than the sum similarly transferred in the previous year, which in turn was some £20,000 less than the figure for 1906-7. A decrease, though of much smaller extent, is likewise shown on the present occasion in the total amount of the deficiencies in revenue which were made good by sums transferred from other accounts of the councils. These deficiencies in the Blue-Book now under review come to £331,988, as against £372,076 the year before—or a reduction of about £40,000 on the figure for 1907-8, which was £50,000 more than that for 1906-7. We are accustomed to find that gas-works contribute to the total profits a far larger share than the other undertakings enumerated, as well as being responsible for the smallest loss; and the year 1908-9 does not furnish any exception to the rule. In fact, the profit on gas-works (£453,530) is very nearly equal to that on tramways, light railways, water-works, and electricity concerns added together; while the loss is less than a one-hundredth part of that of all the other undertakings combined. In the matter of water-works, there is always a much larger aggregate loss than profit; and on the present occasion a total profit of £97,965 has to be set against losses amounting £234,074. Coming finally to electricity, we find that here there is a profit of £100,492 on the one side, and a loss of £40,053 on the other.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 190.)

THE Stock Exchange has had a short but busy week—only four days—and a bright one into the bargain. Much had to be done in connection with the settlement of a long account, which seems to have been satisfactorily adjusted. But, notwithstanding this preoccupation, and in spite of the long holiday interval imminent, there was considerable activity in some markets, coupled with such strength as to impart a widespread tone of cheerfulness. This endured to the end of the working week unimpaired; and the "House" broke up at the close in a mood to enjoy its holiday without misgivings as to what might be in store for it this week. First and foremost in the van of advance was the Railway Market. On the opening day, it promptly showed its strength well maintained. Home Government issues were quiet and featureless; and Consols were steady and unmoved. Americans were rather firmer. Tuesday's business was fairly brisk and showed some good points; but markets were not uniformly better. The gilt-edged classes resented the continued hardening of the Money Market. Consols gave way $\frac{1}{16}$. Railways were active still and had some advances; and there were some bright spots in Miscellaneous. Americans, however, were weak. On Wednesday, the conclusion of the settlement was achieved, business was more active, and the general tone improved. Consols rose $\frac{1}{4}$. Rails were not to be denied—active and full of rise. Thursday was the concluding day, with brisk business and a cheerful tone, unmoved by a few sales to close. Consols were steady, Rails still on the rise, Americans better, and the Foreign Market calm. In the Money Market, there was a good demand, and rates stiffened almost up to the close. Discount was very firm. Business in the Gas Market was on a very fair scale, considering the holiday season, and the tendency showed undiminished strength. In Gaslight and Coke issues, the ordinary was quite steady at the old prices—all transactions being within the limits of 105½ and 106¼. In the secured issues, the preference was done at 101¾ free to 102¼, and the debenture at 80¼. South Metropolitan was also unchanged; being marked at 119 free to 120¼. The debenture was done at 80¼ and 80⅜. Commercials were not touched. Among the Suburban and Provincial group, Bromley "B" was marked at 88½, British at 43⅜ and 43¾ *ex div.*, Hastings and St. Leonards at 94, Ilford "A" and "C" at 144, South Suburban at 119¼ and 119¾, and Tottenham "A" at 141½. In the Continental Companies, Imperial changed hands at from 191½ to 192¼, Union preference at 137½, and European at 19$1\frac{13}{16}$ and 20. Among the undertakings of the remoter world, Monte Video realized 13⅜, Oriental 140½, Primitiva from 7$\frac{13}{16}$ to 7$\frac{15}{16}$, ditto preference 5¼, ditto debenture 97¾, and San Paulo 16.

ELECTRICITY SUPPLY MEMORANDA.

Found Wanting—Revision of the Fixed-Price Scheme at Maidstone—Cold Comfort from Professor Fleming—Cooking and Water and Room Heating—Metallic Filament Disablement—Gas-Proof Street Box.

WE feel that we owe an apology to Mr. E. E. Hoadley, the Electrical Engineer to the Maidstone Corporation, for having suggested a fortnight since that the fixed price per light scheme that he proposed with so much confidence a year since had been in suspension, and had now been revived. Nothing of the kind. The word "suspension" should have been "in operation," and the word "revived" should have been "revised." That properly states the position. The scheme of a year ago has been under trial, and has been found sadly wanting both in its power of attraction, and in its power to bear profit; and the present proposal is the revision of what was done twelve months or so ago. We are not astonished at this; and it shows a defect in the wisdom of trying to apply such a scheme, except at a cost which would be at once protective to the electricity undertaking and prohibitive to the consumer. At best, the fixed price per light scheme is a crude and a poor thing in the way of a business proposition. One has to have a very generous reliance upon human nature; there being no check, without indicators or meters being fixed, upon their use of the lamps. Then to make the plan attractive, the price has to be cut so fine that what has happened at Maidstone must inevitably be the case. The scheme did not pay; and it has only taken a twelvemonth, with a small adoption, to find this out, though there has been as little as possible said publicly about the failure at the price fixed. Does it not follow, if the electricity suppliers have no checks upon the use of the lamps, that, though consumers may start off with the full intention of being honest and careful, there will be a gradually growing indifference to the extent of use?

Mr. Hoadley has very discreetly taken the "bull by the horns," and has remodelled, and got the Council to agree to, the fixed-price tariffs; and the necessity for having to do this should be a warning to others who have a fancy for adopting a fixed rate per lamp. Mr. Hoadley's first scheme was on these lines: The charge made for shops, and licensed and business premises was 10s. per annum for each 32-watt (nominally 25-candle power) lamp, or a flat-rate of 4d, per unit. For private houses, the charge was 8s. per annum for every 32-watt lamp, or a flat-rate of 4d. These are the fixed rates that have not paid. The recommendation that the Electricity Committee put before the Council the other day proposed that, from April 1, the tariff should be: For all shops and business premises, a fixed charge of 8s. per annum for each 32-watt lamp or its equivalent, alight at one time, and 1d. per unit for all electricity consumed. For dwelling-houses: A flat-rate of 4d. per unit for lighting and 1d. per unit for heating and cooking; a fixed charge of 6s. 8d. for each 32-watt lamp alight at once and 1d. per unit for all electricity consumed, whether for lighting, heating, or cooking; or a fixed charge of 10s. per annum for each 32-watt lamp alight at one time. But there was an amendment proposed to the effect that the portion of the recommendation relating to shops and business premises should be referred back to the Committee; and this was accepted. The fact, however, stood out well in the discussion, that, instead of the fixed price scheme having swollen the profits of the concern, it had had the opposite effect. There is also the point that Mr. Hoadley cannot do with less than 10s. per annum per so-called 25-candle power lamp for current alone. It is really a very speculative business. Though our great-grandfathers were trying something of the kind in the gas industry, in the early years of last century, thankful we are that there is no need for the gas industry to enter into any such absurd project nowadays.

It was also suggested, when last we were dealing with this Maidstone affair, that the Gas Company would be able to easily show the substantial difference there is in the cost of running a 25-candle power inverted gas-lamp and the fixed charge for a 25-candle power metallic filament. They had already done so; but their calculations will want revising now. A 25-candle bijou inverted burner has to-day a right to be credited with a maintainable efficiency of no less than 20 candles per cubic foot of gas consumed per hour. Therefore, for 1000 hours' lighting, we may take the following comparison:

One Bijou Inverted 25-C.P. Gas-Burner.	s.	d.	*Fixed Charge per 25-C.P. Metal Filament Lamp.*	s.	d.
1000 hours at 1¼ cubic feet per hour = 1250 at 2s. 6d.	3	1½	One 25-C.P. Osram lamp on contract for one year (estimated to be equal to 1000 hours' use) = ...	10	0
Renewals, two mantles at 4d.	0	8	Renewal, one lamp . . .	3	9
	3	9½		13	9

And yet electricians, without any interest in their present credit or future welfare, are constantly avowing that electricity is as cheap as gas lighting. Mr. Hoadley has come to the conclusion as to what are the minimum figures he can charge; and on these figures he must admit—if he has the courage—that electricity is out of the running in the matter of cost.

Professor Fleming, in the last of his Cantor Lectures at the Society of Arts, dealt with the "Domestic Applications of Electrical Heating." The learned Professor lives high above the realm of practical consideration in this matter; and those who realize this most are the salesmen of electricity. Professor Fleming tells the electricians that they must have low voltages for cooking and heating—nothing higher than 100 volts. The practical objections to this are obvious. He states that for cooking purposes electricity at 1d. per unit is equal to gas at 2s. 8d. That is to say 3425 B.Th.U. obtained by electricity are equal to 17,000 B.Th.U. obtained by gas. If only this were true! Unfortunately for the electrical industry, it is not. All electrical ovens, he says, have their advantages and their disadvantages. That is true; but, again unfortunately for the electrical industry, the disadvantages cause the advantages to show in diminutive proportions. He speaks of the "fumes which so *often* taint the food cooked in a gas-oven." Strange that Professor Fleming has discovered any such taint, and we have not during twenty-five years' daily use of gas-ovens. It may be taken that Professor Fleming refuses to dine anywhere where cooking is performed by the use of gas. If so, his patronage of the West-end dining establishments and the London hotels is *nil;* and surely he can never pluck up courage to attend a public or other dinner in London. With this tainting of food "so often" by gas fumes, it is wonderful that the popularity of the gas-cooker grows at such a magnificent rate; and it is equally wonderful the big catering establishments that adopted cooking by gas years ago have succeeded in keeping their doors open. Truly the electricians, in their commercial ardour, try to make out that this is a queer, topsy-turvy old world, and that the major part of the people living in its most civilized quarters are little better than lunatics—always excepting the electricians themselves. Strange, however, that among the electricians there are few who use the electric oven. We recently came across an instance where one was introduced into the domestic equipment of a house, one of the members of the domestic circle of which is employed by an electricity concern. The oven was lauded for the first week or two while it was a novelty to the presiding member of the household. Six weeks later its reign came to an end.

Professor Fleming speaks of the heating of water by gas and electricity. He says that a fair comparison is difficult; and, as a matter of fact, he has very little to say about this matter. It was just as well. But he instanced a case in which 2½ pints of water took fourteen minutes to boil with 1·8 cubic feet of gas, which, putting time and consumption together, was rather bad work. Taking the calorific value of gas as equivalent to 550 B.Th.U. per

cubic foot, he said this represented a heating efficiency of somewhat less than 50 per cent.; but using a kettle with a tubular bottom this might be increased to 64·5 per cent. At a price of 2s. 6d. per 1000 cubic feet, the 1·8 cubic feet would only cost 0·054d. To heat only one pint of water from 60° Fahr. to 212° Fahr. by electricity would require 330 watts. With these figures, on the Professor's calculations, before them, our electrical friends may amuse themselves with comparisons. On the question of heating water by the "Therol" heater, a twenty-four hour test was quoted which showed that it took about 7½ units of electricity to raise 38·4 gallons of water from 60° to 110° Fahr., representing an efficiency of 92 per cent. Haphazard we take from some records of gas-boiler duties a case in which 30 gallons of water are supplied for a hot bath on a consumption of 25 cubic feet an hour; and there are several forms of gas apparatus on the market by which hot water in large quantities can be obtained at will, and without waiting. That is much better than making up one's mind one day to have a hot bath, and having to wait till the next for the water.

One point about the heating of rooms. It seems that before electrical heating can be adopted with real advantage, our houses must be reconstructed. Professor Fleming says the rooms should have no chimneys, and should be ventilated by electric fans. More efficient means, too, are required to prevent conduction through walls, doors, &c., of the average dwelling-house. He showed, by curves, the great advantage accruing from the use of double windows and thick walls. Of course, it is necessary to prevent the heat escaping from electrically heated rooms, as in all conscience there is little enough of it. The Professor also advocated that three electric heaters should be distributed in a room, and that there should not be reliance on one large unit placed in a fire grate. That too is sound advice. But what cold comfort is this Cantor Lecture for the electrical people who are looking to domestic heating for supplementing business! Professor Fleming has not added much to the knowledge of Domestic Economy.

When a metallic filament lamp has a fairly long run before giving up service, the electrical industry rings with the good news; and the lamp, in being laid to its final rest, is treated with the reverence and respect that are due to an old and intimate friend. When, under the regulated conditions of the laboratory or under the tender care of the manufacturer, a few lamps are got to run continuously for (say) a couple of thousand hours, the testimony to longevity is duly chronicled. But, as a matter of fact, there is perhaps nothing of a commercial nature—not even eggs—that suffer such an extent of erratic life as metallic filament lamps. Ask the lamp retailers; and they will put another complexion on these long-life tales. The matter was raised at the meeting of the Ironmongers' Federated Associations recently, upon a motion that the manufacturers of metallic filament lamps should be urged to increase their discounts, so that the distributors might receive some compensation for losses incurred through breakages. The percentage of lamps broken seems to allow the retailers but insignificant crumbs of profit, though 20 per cent. discount is granted. One manufacturing company have agreed to spring another 5 per cent., but the suggestion has only met with scowls in certain other quarters. The makers, on the other hand, are represented to have but little pickings at the present prices, so the position is rather a difficult one. However, the retailers may make a bigger impression on the manufacturers through the Ironmongers' Federated Associations than they can do individually or through any local Association.

A firm in South Bermondsey have made a very sensible proposal. Gas-pipes have been tenants of the streets for many decades. Long after came electricity distribution systems, in which were introduced street-boxes that were not impervious to accidental leakages of gas. Consequently, there has been trouble, though all the trouble reported has not been attributable to leaking gas—a goodly proportion having been due to the generation of gas by the action of fusing mains on the insulation of cables. Ventilation of the street-boxes has been adopted; but this in turn has raised the question of the access of water to the boxes. Now the South Bermondsey firm has brought out a gas-proof box, which is made of impervious slabs of artificial stoneware, jointed in a manner that makes the box practically monolithic and entirely gas-proof. The ends of the ducts round the cables can be sealed with bitumen, so as to ensure that nothing gets in that way. The only objection we can see to a gas-tight box of the kind is that an electricity undertaking using them will not be able to blame gas if an explosion should occur. Gas has a reputation for pretty broad shoulders in the electrical industry.

We are pleased to learn that Mr. JACQUES ABADY has arrived home safely and well from his visit to Calcutta, and we find, from last week's proceedings at the Westminster City Council, that he has already again taken up his public duties, and has settled down to his more immediate professional work.

On the occasion of his leaving Glasgow to take up a position in the chief office and works of Messrs. James Milne and Son, Limited, the General Committee of the Imperial Union Club and a large number of the members recently entertained Mr. HUGH STRATHEARN at dinner. Mr. Arthur Hart proposed Mr. Strathearn's health, and assured him that he would carry with him into his new sphere the gratitude and best wishes of every member of the club. In reply, Mr. Strathearn said he felt overwhelmed by the honour and kindness which had been shown him, the recollection of which would always remain with him.

GAS PUBLICITY WORK.

Memorandum Explanatory of the Scheme.

IN the notice of the Gas Publicity Conference in the "JOURNAL" last week (p. 95), allusion was made to a "Memorandum" that was read by Mr. F. W. GOODENOUGH after the opening remarks of the President, Mr. Alex. Wilson, of Glasgow. The conference was a private one, though permission was given to the publication (as was done last week) of an indication of the course of the proceedings. Since then the Committee have sanctioned the publication of the "Memorandum," which is as follows.

NATURAL INQUIRIES.

When asked to subscribe to any fund for the general benefit of the industry, every gas administrator naturally wants to know—

(1) For what precise purposes the money is required.
(2) How much is wanted.
(3) How it will be spent.
(4) By whom it will be spent.
(5) In what way his particular undertaking will benefit.

The object of this memorandum is to answer these questions as fully as possible in regard to the appeal for funds that has been issued by the Publicity Committee.

For this purpose it is necessary to repeat, while at the same time somewhat expanding, the explanations already published of the scheme proposed by the Committee.

PURPOSES FOR WHICH THE PUBLICITY FUND IS REQUIRED.

The primary object of the fund is to increase the sale of gas throughout the country.

In these days of intensified competition, intensive culture of his territory is recognized as essential to success by every business man of repute. This full development of the possibilities of any business can only be achieved by the persistent, skilful, and convincing presentment to the public of the advantages they will derive from the buying of the product that it is desired to sell; and by the vigilant and successful reply to attacks made upon that product by those interested in competing goods.

Briefly, full commercial success can only be achieved by advertising in all its many forms—now frequently described by the general term "Publicity." By giving the fullest possible publicity to the many advantages of gas for the great variety of purposes for which it can be used, the sale of gas can be materially increased. This can be done, and is being done, to a very considerable extent, and in many cases in a highly efficient manner, by the various gas undertakings in their own localities.

But there are many very important methods of securing publicity for an article which cannot be adopted by any one gas undertaking, but which could be adopted by many undertakings acting in co-operation, with great advantage to all. It is for the purpose of making use of these methods for the benefit of the industry as a whole that the Publicity Committee has mainly, though not wholly, been constituted, as the outcome of a very strong feeling among a large number of the principal administrators of gas undertakings in all parts of the kingdom in favour of a combined advertising campaign.

Among the methods that are open to the advertiser whose wares command a universal market may be mentioned:—

Advertisements in weekly and monthly periodicals of general circulation—for example: "The Gentlewoman," "The Sketch," "Black and White," "Strand Magazine," "The Woman at Home," "Fashions for All," and very many other periodicals of similar class appealing to the lady of the house, whose good opinion is so invaluable to the gas salesman.

Frequent news paragraphs in such periodicals, and contributed articles advocating the use of gas from the domestic-economy, hygienic, and labour-saving points of view, written by well-informed and skilled journalists, and particularly by women writers who have made the problems of household administration their special study.

Advertisements in periodicals of widespread but special circulation, such as those appealing especially to builders and architects, to the medical profession, and to all the various trades that are large users of gas. Frequent news paragraphs in such periodicals, and contributed articles by qualified writers.

Advertisements in newspapers of general rather than purely local circulation—*i.e.*, the principal London and Provincial dailies. Frequent news paragraphs in these papers, and contributed articles by qualified writers; also letters, written by, or at the instigation of, the Committee, correcting misstatements calculated to do injury to the industry.

Advertisements on railway stations and in railway trains throughout the country.

By these and similar means, it would be sought to create a cumulative impression in the minds of the public—which can only be done by consistent and persistent publicity work—that gas is the up-to-date thing to use, and is approved by the authorities in the worlds of science and hygiene.

None of these methods, on any adequate scale, is open to the individual gas undertaking; and, deprived of their support, local effort, however good, however strenuous, however thorough, must fail to produce the full harvest that, with the aid of this background

of general publicity, this persistent use of the power of suggestion, undoubtedly awaits the industry, if only it is prepared to sow the seed and have faith and patience while the corn is growing.

This general publicity work would not, however, be the only purpose for which the funds of the Committee would be spent. To carry out the work already outlined, it is obvious that the Committee would have to employ expert advertisement designers (both artists and copy writers), directed, and informed in the special requirements of the industry and the public it has to serve, by an Executive Committee.

These experts would, in addition to preparing suitable advertisements for the papers and periodicals of general circulation above referred to, be employed in preparing advertisements (and articles) suitable for insertion in local papers in which any subscribing undertaking might desire to advertise on its own account.

Such skilfully prepared copy would be designed well in advance of the season to which it was suited; and proofs of a whole series of advertisements, designed (say) to advocate the use of gas-fires, or cookers, or water-heaters, or furnaces, would (some months before they would be required for insertion) be circulated to subscribers, to enable them to decide on what they would use, and to order blocks of the required size in good time. The blocks could then be purchased from the Committee at the lowest possible prices—or, if the copy were reading matter only, the copyright would be at the disposal of the subscriber free of charge—and the local undertaking would have the benefit of the best advertising brains obtainable in the kingdom to design its local advertisements, and would have been saved all the trouble of thinking out and designing copy which is often required just when a manager is most busy.

Similarly, experts would be employed to design posters, showcards, illustrated booklets, picture post-cards, and other advertising matter desired for local distribution, which would be available for purchase by subscribing undertakings at a minimum of trouble and at lower prices—because the Committee could buy on wholesale terms—than any individual undertaking could possibly obtain for itself.

Further (always provided that funds permitted), the Committee would make grants in aid of exhibitions of a more than purely local character, and would afford assistance, if desired, in the organization of purely local exhibitions, and arrange for qualified lecturers to be available at a reasonable cost.

The Committee would, in fact, aim at organizing and developing the selling side of the gas industry in every possible way.

It may be added that the object of the Publicity Committee would be not a campaign against electricity, but a campaign in favour of gas—not merely as an illuminant, but as a fuel, both domestic and industrial, and as a motive power. Where and when gas is attacked, it must be defended; but making constantly public its many advantages and utilities would be the main object of the Publicity Committee.

Administration of the Funds.

"No taxation without representation" would be the principle upon which the Committee's constitution would be based; it being proposed that every undertaking subscribing to the fund should be represented on the Committee, which would then elect a General Committee to direct the operations of the organization and control the administration of the funds.

A small Executive Committee, working under the supervision and control of the General Committee, would be appointed to conduct the detailed work of the scheme. The Publicity Committee as a whole would meet from time to time to receive reports from the General Committee and to discuss questions of general policy.

How Each Individual Undertaking would Benefit.

This point has already to some extent been dealt with.

In the first place, the whole industry benefiting by the attention of the public being continuously (and by means hitherto unused, or but slightly used) drawn to the advantage and various uses of gas, each component member of the whole must benefit proportionately to its magnitude. That is the ground upon which is founded the principle that all undertakings should contribute, and should contribute upon a fixed basis of an agreed sum per million cubic feet of gas made.

It would, no doubt, rarely be possible for any individual manager to put his finger on any particular items in his sales and say, "This or that was due to co-operative publicity." But instances have already occurred where results have been directly traced by one company to the advertising done by another in periodicals of general circulation; and it only requires a reasonable amount of imagination and faith for every manager to realize that co-operative publicity work on a liberal but carefully arranged basis must be of proportionate benefit to all.

That is the first answer to the natural query of the cautious administrator, "Where do *we* come in?"

In the second place, as already indicated, every subscribing undertaking would have the services of the best experts and artists obtainable to aid them in their local publicity work, thereby relieving them of the necessity of doing a lot of pamphlet writing, poster or showcard designing, and advertisement copy-writing work themselves.

In the third place, the cost of local publicity work would be materially reduced by the co-operative instead of individual purchase of advertisement matter. This co-operative buying has already been done by a few companies to their mutual advantage; and it could be extended generally with very advantageous results, both in regard to quality and price.

Finally, there is the question:

How Much Money is Wanted?

Is 2s. 6d. per million cubic feet of gas made too large a sum to ask gas undertakings to subscribe, in addition to paying for their own local publicity work?

This question only needs to be put on a basis of comparison with what is done by other big trading enterprises, or with what is done by the gas undertakings of America, to be answered emphatically in the negative.

The gas industry has an invested capital of £132,000,000. A subscription of 2s. 6d. per million cubic feet—*i.e.*, 0·03d. per 1000 cubic feet—by every undertaking would realize about £25,000 a year. This is 0·02 per cent. on the invested capital, and is far less than the amount spent by many of the large business firms in this country of very far smaller magnitude than the gas industry. In America, one gas company alone allocates £10,000 a year to its publicity work.

£25,000 a year would not be a penny too much to spend on general publicity work for the whole of the British gas undertakings; and it must not be forgotten that, in advertising, small, inadequate sums can be absolutely lost because they are not large enough to ensure the general and cumulative effect that is the essence of success in publicity work.

The basis fixed is, it is submitted, on the low rather than on the high side; and it is essential to the success of this movement that the large majority of undertakings should become subscribers, and should subscribe at the full rate of 2s. 6d. per million cubic feet made.

The time is ripe for action to be taken, for the experiment (if there be any who so regard it) to be made. It can only be made in an effective manner if the industry as a whole is prepared to co-operate by investing the comparatively small sum asked for in the scheme; and, having done so, to have faith in the result, and patience in awaiting it.

For the Committee,

April, 1911. Alexander Wilson, *President*.

The Committee on Local and Imperial Taxation.

In the "Journal" last week (p. 94), reference was made to the formation of a Committee, under the chairmanship of Sir John Kempe, K.C.B. (the Comptroller and Auditor-General), "to inquire into the changes which have taken place in the relations between Imperial and local taxation since the report of the Royal Commission on Local Taxation in 1901." The names of the Committee were given; and it was mentioned that an endeavour was being made to secure the services of someone familiar with the conditions existing in London. The Chancellor of the Exchequer asked the London County Council to place at his disposal the services of Mr. E. J. Harper, the Statistical Officer, as a member of the Committee. The Council replied that, while they were grateful to him for his offer to give special representation to London on the Committee, they naturally expected that their chief financial officer, the Comptroller of the Council (Mr. H. E. Haward) would have been selected, particularly as he had for many years given special attention to the difficult and complex question to be considered by the Committee, and was recognized by the Municipalities of the United Kingdom as an authority of great and peculiar weight on the subject. The Council suggested that the Statistical Officer should be allowed to give evidence before the Committee. The Chancellor of the Exchequer replied that, while he was well aware of the great ability and experience of Mr. Haward, none of the members of the Committee were being appointed in a representative capacity, and consequently it was not intended to nominate one to represent the interests of London. He asked if it would be possible for the Clerk of the Council (Sir Laurence Gomme) to serve as a member of the Committee. At the meeting of the Council last Tuesday, the action of the Chancellor of the Exchequer was the subject of a long discussion; and it was eventually resolved, on the recommendation of the General Purposes Committee, to decline the invitation to lend the services of any officer other than the Comptroller. They expressed the hope that, when action was taken on the report of the Committee, Parliament would see that the grievances of London ratepayers were substantially redressed.

The repair of a broken steel main of the Wilmington (Del.) Water-Works is the subject of a note in the last annual report of Mr. John A. Kienle, the Chief Engineer of the Water Department of the city. The main was 48 inches in diameter, and the break occurred in the butt strap connecting two sections of pipe. The strap cracked between the lines of rivets, probably owing to the combined influence of the settlement of an adjacent bridge approach and the effects of expansion and contraction of the pipe. The water was turned into an existing bye-pass line while repairs were in progress. It was impossible to mend the break by using a standard cast-iron split sleeve, so a similar device made from $\frac{3}{8}$-inch boiler-plate was adopted.

THE METROPOLITAN GAS COMPANIES' ACCOUNTS.

For the Year 1910.

—	Gaslight and Coke.	South Metropolitan.	Commercial.	All the Companies.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Capital and borrowed money (including premium capital)	29,172,991 8 5	8,325,340 0 0	2,659,819 14 3	40,158,151 2 8
Income—viz.:				
Sale of gas by meter	3,133,925 13 2	1,295,471 16 10	..	..
Public lighting and under contracts	137,926 13 10	33,953 2 8	..	..
Total gas rental	3,271,852 7 0	1,329,424 19 6	387,706 5 9(g)	4,988,983 12 3
Rental of meters	130,590 6 6	78,296 8 0	34,309 4 8	243,195 19 2
Rental of stoves, fittings, &c.	222,335 5 0(a)	143,392 11 3(e)	21,087 5 8(h)	386,815 1 11
Residual products—				
Coke and breeze	594,237 17 8	313,831 18 2	63,702 11 2	971,772 7 0
Tar and tar products	110,414 5 1	65,400 2 10	15,778 11 10	191,592 19 9
Ammoniacal liquor and sulphate of ammonia	203,094 5 10	122,212 3 7	20,994 10 6	346,300 19 11
Miscellaneous, including old materials	24,624 4 7	15,834 19 7	1,087 5 9	41,546 9 11
Total income from all sources	4,557,148 11 8	2,068,393 2 11	544,665 15 4	7,170,207 9 11
Expenditure—viz.:				
Coal, including carriage and dues	1,118,008 0 0	662,162 4 10	173,775 2 0	2,060,137 13 11
Oil, do.	106,192 7 1	..		
Coke and breeze used in making carburetted water gas	75,249 2 10	..	..	75,249 2 10
Salaries of engineers and officers at works	31,159 10 6	29,113 1 1	5,503 3 11	65,775 15 6
Wages—manufacture	194,971 5 5	89,255 1 1	23,309 10 11	307,535 17 5
Purification	24,457 15 5	28,575 3 2	2,878 7 6	55,911 6 1
Wear and tear—manufacture	404,449 3 11	268,131 2 6	62,431 14 4	735,012 0 9
Salaries and wages—distribution	105,069 10 1	40,170 4 0	9,627 16 5	154,867 10 6
Repair and maintenance of mains and services	170,104 15 5	69,327 17 2	12,710 7 11	252,143 0 6
Repair and renewal of meters, stoves, &c.	368,997 4 7(b)	220,965 3 3(f)	45,184 5 11(i)	635,146 13 9
Lighting and repairing public lamps	50,252 8 10	10,881 8 0	4,976 6 2	66,110 3 0
Rents, rates, and taxes	313,004 6 10	93,741 18 9	25,499 17 4	432,246 2 11
Salaries—management	19,271 13 5	7,472 5 1	2,627 14 10	29,371 13 4
Collectors' salaries and commission	51,472 16 1	31,059 5 2	9,461 9 3	91,993 10 6
Stationery, printing, and general charges	25,015 1 3	26,290 4 7	5,406 3 0	56,711 8 10
Directors and auditors	7,906 6 0	6,155 11 10	2,650 0 0	16,711 17 10
Co-partnership and profit-sharing schemes	28,798 17 3	41,133 14 6	6,132 13 1	76,065 4 10
Annuities to officers and workmen	68,668 2 0(c)	14,679 8 3	2,480 16 7	85,828 6 10
Law and parliamentary charges	7,280 1 2	4,256 13 8	641 9 7	12,178 4 5
Bad debts and extraordinary expenses	21,765 5 11(d)	5,141 17 7	1,936 14 5	28,843 17 11
Total expenditure on revenue account	3,192,093 14 0	1,648,512 4 6	337,233 13 2	5,237,839 11 8
Gross profit	1,365,054 17 8	419,880 18 5	147,432 2 2	1,932,367 18 3
Do. per cent. on capital and borrowed money	4 13 7	5 0 10	5 10 10	4 16 3
Do. do. gas-rental	41 14 5	31 11 8	38 0 6	38 14 8

(a) Stoves, £107,332 10s. 2d.; fittings, £222,335 5s. (b) Meters, £148,190 9s. 11d.; stoves, £151,948 18s. 1d.; fittings, including labour (automatic-meter supplies), £368,997 4s. 7d. (c) Including £4549 8s. 8d. paid to workmen's compensation account. (d) Including balance of £285 15s. paid for stamp and conveyance duties, under the Company's Act of 1909. (e) Including £81,807 18s. 1d. received for gas-fittings. (f) Meters, £51,488 4s. 11d; stoves, £80,442 0s. 10d.; fittings, £89,034 17s. 6d.; (g) £395,323 17s. 8d., less £7617 11s. 11d. for discounts and allowances. (h) Including £1260 14s. 4d. for maintenance of incandescent mantles. (i) Made up as follows: Meters, £4429 3s. 4d.; stoves, £17,505 19s. 8d.; fittings, £21,994 12s. 6d.; and maintenance of incandescent mantles, £1254 10s. 5d.

THE CAPITAL, INCOME, EXPENDITURE, AND PROFIT OF THE COMPANIES

Per 1000 Cubic Feet of Gas Sold in 1910.

—	Gaslight and Coke.	South Metropolitan.	Commercial.	All the Companies.
	s. d.	s. d.	s. d.	s. d.
Capital and borrowed money (including premium capital)	23 3·90	13 2·66	16 3·70	19 7·82
Income—viz.:				
Sale of gas by meter	2 6·07	2 0·69	..	..
Public lighting and under contracts	1·32	0·64	..	..
Total gas-rental	2 7·39	2 1·33	2 4·53	2 5·30
Rental of meters	1·25	1·49	2·52	1·43
Rental of stoves, fittings, &c.	2·13	2·74	1·55	2·27
Residual products—				
Coke and breeze	5·70	5·98	4·69	5·71
Tar and tar products	1·06	1·25	1·16	1·13
Ammoniacal liquor and sulphate of ammonia	1·95	2·33	1·55	2·03
Miscellaneous, including old materials	0·24	0·30	0·08	0·24
Total income from all sources	3 7·72	3 3·42	3 4·08	3 6·11
Expenditure—viz.:				
Coal, including carriage and dues	10·73	1 0·62	1 0·79	1 0·10
Oil, do.	1·02	..		
Coke and breeze used in making carburetted water gas	0·72	..	..	0·44
Salaries of engineers and officers at works	0·30	0·56	0·40	0·39
Wages—manufacture	1·87	1·70	1·72	1·80
Purification	0·23	0·54	0·21	0·33
Wear and tear—manufacture	3·88	5·11	4·59	4·32
Salaries and wages—distribution	1·01	0·77	0·71	0·91
Repair and maintenance of mains and services	1·63	1·32	0·94	1·48
Repair and renewal of meters, stoves, &c.	3·54	4·21	3·32	3·73
Lighting and repairing public lamps	0·48	0·21	0·37	0·39
Rents, rates, and taxes	3·00	1·79	1·88	2·54
Salaries—management	0·19	0·14	0·19	0·17
Collectors' salaries and commission	0·49	0·59	0·70	0·54
Stationery, printing, and general charges	0·24	0·50	0·40	0·33
Directors and auditors	0·08	0·12	0·19	0·10
Co-partnership and profit-sharing schemes	0·28	0·78	0·45	0·45
Annuities to officers and workmen	0·66	0·28	0·18	0·50
Law and parliamentary charges	0·07	0·08	0·05	0·07
Bad debts and extraordinary expenses	0·21	0·10	0·14	0·17
Total expenditure on revenue account	2 6·63	2 7·42	2 5·23	2 6·76
Gross profit	1 1·09	8·00	10·85	11·35

THE HAWES DISASTER AND GAS LIGHTING.

[COMMUNICATED.]

THE report by Major Pringle, R.E., Inspecting Officer to the Board of Trade, on the railway disaster at Hawes Junction [and referred to in the "JOURNAL" for the 4th inst.] has raised once more, in an acute form, the differences between gas and electric lighting for railway carriages.

The force of the collision, it will be remembered, was such that the two front carriages telescoped, the upper and wooden portions being very much crushed; while the steel underframe of the second coach penetrated more than half way beneath that of the front coach. In doing so, the compressed oil-gas cylinders underneath the front coach were apparently torn from their position and pierced; while the connections to the gas-cylinders on the second coach were severed.

It may be of advantage, in the first place, to examine the Inspecting Officer's remarks in regard to the origin of the fire, and some of his suggestions; while, afterwards, there are certain facts to which it is desirable to refer. Major Pringle says:

> "The gas-cylinders are filled to 105 lbs. pressure, and the gas is led by high-pressure ¼-inch pipe connections to a gas-regulator, where the pressure is reduced to 11 lbs."

This latter statement should manifestly have been 11 inches (water-gauge); and although the inaccuracy could not make any difference to the Inspecting Officer's conclusions, it is peculiarly unfortunate, coming as it does from an official Government source.

> "It cannot be denied that compressed oil gas stored in the cylinders under the first two coaches was the origin of the fire in this case. . . . But *the elimination of gas as the source of light would not preclude all danger from fire.** There remains the risk from the contents of the engine fire-box, and from the employment of coal, coke, or gas in cooking ranges and stoves on the restaurant cars. Instances of fires so originated can be readily quoted—*e.g.*, at Grantham and possibly Cudworth. In fact, *this is actually the first occasion when it can be proved, beyond question of doubt, that fire was occasioned by burning gas.* It has to be remembered also that gas has been in use for lighting purposes for a very long period; and that during the whole of that time—in fact, since the year 1868—there is no case of fire destroying either the lives or bodies of passengers in a railway accident."

Major Pringle goes on to say that incandescent gas has "many practical advantages over electricity as a source of illumination. It requires no expert staff, is nearly as easily controlled, is more economical to instal and maintain, and is less liable to failure as an illuminant." Certain suggestions are then put forward for consideration, which if carried out might minimize the risk of fire.

> "(1) The provision of a valve, which, when the rush of gas exceeds that due to a certain pressure, shall automatically close and prevent the further issue of gas."

If this could be provided, it would probably form an additional safeguard; but in cases such as the Hawes disaster, where the gas-cylinders and underwork of the carriages were mixed up in inextricable confusion, it is very doubtful if such a valve would be left in working order.

> "(2) The strengthening of the ends of the cylinders themselves, so that they shall be less liable to damage or perforation as the result of a blow."

This seems a very reasonable and useful suggestion, and one which should be carried out, as the gas cylinders of the first coach were perforated in several places.

> "(3) A decrease in the size of the diameter of the cylinders, and improvements in their housing and protection, as well as of the gas-mains, so that they may be less likely to be struck and damaged."

Perhaps something might be done to make improvements in this case; but it is doubtful if piping or cylinders of any kind—no matter how strong or well protected—would be of much value in a serious smash such as this, where there was "a mass of woodwork," and "tangled steel rodding, framing, wheels, &c." Could the storage cylinders be made of some material which would, on receipt of a heavy blow, crack—such for instance as glass—and allow all the gas to escape at once?

> "(4) Placing the gas-cylinders on the roof."

This precaution would almost certainly have avoided the conflagration in the Hawes disaster; and the suggestion deserves very careful consideration. It is, however, open to other objections.

> "(5) The provision of some incombustible material—*e.g.*, uralite—above or below the cylinders, according to the position adopted, of sufficient area and thickness to render firing of the woodwork from burning gas less probable."

This also seems a very desirable and necessary precaution to adopt.

One or two salient points connected with the mishap cannot but attract attention. Firstly, the fire did not originate from the gas-lights; for the coaches were immediately plunged into darkness by the disaster. It is instructive to remember that it has always been the danger from naked gas-flames which has been dwelt upon hitherto; but these were, of course, instantly extinguished. The Inspecting Officer states that "there is no evidence of incandescent coal or ash having been seen on the permanent way, which might have lighted the gas." But he goes on to suggest that the gas became "ignited from the sparking and flashing which went on, caused by the grinding together of the steel underframes, the passage of the wheels over broken rails and ballast," &c. It cannot be denied that a great stream of oil gas rushing from a broken cylinder or severed pipe, once lighted, is a difficult thing to deal with; but there can be little doubt that if the two jets of flame which are mentioned in the evidence as probably causing the fire had been resolutely tackled at first, they could have been extinguished. Indeed, Engineer-Lieut. M'Ghie, R.N. (one of the passengers), put his gloved hand over the end of one of the broken pipes, thus extinguishing the flame. He attempted to do this in the other case, but found that the fire had been alight too long, and had got too great a hold, and he was driven back by the heat. His opinion, however—that, if he had been on the spot slightly earlier, he might have extinguished the other jet—should be recorded. The only action taken to extinguish the fire by both passengers and railway officials would appear to have been the throwing of water upon the two long gas-flames; and this, as might have been expected, did not have much effect. Unquestionably, sand or earth or mud (as it was raining) would have been of more value in dealing with a high-pressure flame, some 3 or 4 feet long, if only someone had had the knowledge and presence of mind to apply it early.

The gas which caused the trouble was oil gas of high calorific value, and would therefore be very much more dangerous than coal gas, which has only about half the heating value. Had coal gas been in use, the danger from fire would have been very greatly lessened, and certainly the woodwork of the coach would not have ignited so readily. This is a very powerful argument for the use of coal gas; for not only is coal gas safer owing to its lower calorific value, but it is cheaper to use. It is, therefore, to be hoped that railway companies will now seriously think of adopting it generally in preference to the more costly oil gas.

Where recommendations are made as in this case there is always another side to be considered. In all the correspondence about gas train lighting, we have heard very little of the dangers and difficulties of electric train lighting. Major Pringle gives voice in his report to what is a well-known fact. "Gas . . . is less liable to failure as an illuminant." Railways would be in a very awkward position were they to adopt universally an illuminant with any liability to failure. The result of carriages being plunged into darkness would certainly cause an added list of outrages of a more or less serious nature, and would be a natural incentive to theft. Furthermore, in any serious disaster the acid from the storage batteries would be thrown about, the wires cut and tangled, and any switches or fuses probably put out of action. There might, therefore, be a serious amount of sparking from short-circuiting, besides which rescuers might be faced with additional danger of electric shocks. It may be that the voltage employed on railway carriages would not actually kill a man; but with a good quantity of current, it would give anyone a severe shock. These are points, among others, which it is only right should be given prominence in any discussion on the comparative safety of the two illuminants.

Major Pringle's remarks concerning the economical nature of incandescent gas lighting thoroughly confirm the opinions held by every railway lighting engineer who has gone fairly into the question of cost. Compared with electricity, a modern gas-lighted coach makes a saving of some £9 per annum if oil gas is used and some £14 per annum if coal gas is employed. Applying these figures to the rolling stock of the Midland Railway, who own about 3600 passenger vehicles, it is found that an annual saving of somewhere about £32,000 would be made were oil gas the only illuminant, or about £50,000 if coal gas were the illuminant, as compared with the annual cost were electricity the illuminant.

There can be no question of converting the present gas-lighted stock to electricity, on account of the huge expenditure involved. The only point remaining, therefore, is how new coaches are to be illuminated. The Board of Trade report certainly recommends that "electricity should be adopted wherever possible." But in the same report it is admitted that this is the first accident known in this country to be definitely attributable to gas (?), and that never since 1868 have passengers' lives or bodies been destroyed by fire. Seeing that incandescent gas is acknowledged to have "many practical advantages over electricity as a source of illumination," it may very well be asked whether it is reasonable to condemn gas-lighting wholesale through one mishap said to be attributable in a measure to it. When accidents are caused by steam-engines overrunning signals, have recommendations ever been made to instal apparatus which would prevent this, as might quite well have been done? No. The running of electric trains is ten times more dangerous on account of fire than all the gas train lighting in the kingdom. Yet who complains? In several recent lamentable disasters on electric railways caused by electric current—such, for instance, as that at Seaforth and that on the Paris underground—has it been urged that electric traction should be done away with, even although it has led to serious loss of life? Certainly not. In the case of these and other accidents involving the deaths of passengers, steps have been taken to do what is possible to minimize the danger; but it has always been accepted that suggestions made shall be reasonable, and not require expense out of proportion to the benefits received. For instance, if a more costly system of signalling had been in use at Hawes—such, for instance, as track-circuiting—the disaster in question could never have occurred. But no suggestion was made to instal this universally. In the same way it is hardly reasonable to impose

* The italics are the author's.

such a heavy burden of extra expense as electric lighting would be on railway companies, who are seriously harassed financially in many directions as matters stand.

The difference in cost to the Midland Company between the use of coal gas for carriage lighting and electricity—*i.e.*, say £50,000 a year—is too great a sum to throw away annually because once in forty years gas is blamed for augmenting a mishap. We have to regulate our daily lives for ordinary requirements and circumstances, and not for extraordinary ones such as the Hawes disaster, besides which if only prompt repressive measures had been taken, the flames coming from the escaping gas could have been easily extinguished. We certainly live in a country where, and in an age when, infinite precautions are taken to save life; but we must all of us run a certain amount of risk. As for that said to be inherent in the gas lighting of trains, it is infinitesimal; and it is to be hoped that the railway companies will not allow themselves to be led away by a momentary panic—partly raised by people ignorant of the real facts (*vide* the letters to the Press in all parts of the country), and partly due to interested parties, who have their own ends to serve.

GAS ENGINEERS' LABORATORY HANDBOOK.*

The third edition of this widely used text-book has come to hand; and but for the inclusion of a method of determining the quantity of naphthalene in gas and a description of the Boys calorimeter, nothing has been added to that contained in the previous edition. It is a book which may be found in nearly every gas-works, and one which, from the nature of its contents, is constantly in use. A short description of the subject-matter will interest those who have not yet made its acquaintance.

Part I. treats of various preliminary operations necessary in quantitative work, such as the use of the balance, the preparation of substances for analysis, and the ordinary operations employed in analysis. For instance, in this part are described the methods of sampling, drying, evaporating, precipitating, and filtering generally employed in analytical work. In Part II., which is somewhat short, is described the method of estimating gravimetrically certain pure substances which are typical of the analyses commonly required in gas-works. Part III. deals with volumetric analysis, and includes notes on the preparation of solutions and the indicators generally used in the volumetric estimation of acids and alkalies. Part IV. describes the more complex determinations required in gas-works; some being gravimetric, others volumetric, while some embrace both methods. These include complete analyses of coal, fresh and spent purifying material (lime, oxide, and Weldon mud), ammoniacal liquor, sulphate of ammonia, fire-bricks and clay, tar, crude gas for CO_2, SH_2, and NH_3, and purified gas for NH_3 and sulphur compounds. Part V. treats of technical gas analysis, calorimetry, estimation of cyanogen, and valuation of oils for gas-making purposes.

The book is excellently arranged and well written; and there is little room for criticism. There are, however, one or two omissions. For instance, no mention is made of Somerville's apparatus for the estimation of sulphuretted hydrogen and sulphur compounds in coal gas. Further, no particulars are given of pyrometers, which have now found their way into many gas-works. In the appendix, a great many useful tables are included; but it is noticed that in one table giving the solubility of gases in water figures are only stated for water at from 0° to 20° C. These figures are of very little use at such low temperatures, and, further, no formula is given by means of which the degree of solubility of gases in water at higher temperatures may be calculated.

As mentioned before, little has been added to that contained in the previous edition; but this is hardly surprising as Mr. Hornby's book is, for the purpose intended, very complete, and the requirements of the gas-works chemist have increased but little in the years which have elapsed since the last edition was published.

DISTRIBUTION BY STEEL.†

The object of this work is to describe the various methods by means of which gas may be satisfactorily distributed in steel mains. The authors go further, and give the reader the impression that the laying of cast-iron mains, especially when jointed with cast lead, is a retrograde practice. Their contention is that "We lay our mains of cast iron chiefly because our fathers have done the same before us." Their condemnation of the cast-lead joint is undoubtedly in some measure justified; for, even if well made and caulked, it can at best only be satisfactory so long as the main is undisturbed. It allows little for movements or subsidence; and for this reason as a joint it cannot be compared with the excellent rigid type of joint devised by the authors. As to the most desirable material of which distributing pipes should be made, the authors submit the proposition that "a cast metal is not suitable for pipes as compared with a wrought." With this expression of opinion many engineers will not agree, though there are many positions in which mains must be placed where the superiority of the steel main is indisputable. The authors, however, make out an excellent case for their contentions; and the perusal of this book will make converts of many readers.

No one can dispute that the authors' three main arguments in favour of steel tubes—viz., the unbreakable material, the long lengths (one of steel to three of cast iron), and the resiliency—constitute very substantial advantages. And, further, the authors state "there are other subsidiary advantages, the lightness in handling, saving in freight, and less depth at which it is necessary to lay unbreakable mains, not to speak of the rapidity and ease with which main-laying can be carried out. There is also the restoration of the 2-inch minimum size of main dealt with under the heading of service connection on p. 60. All these go to make up a saving in cost of main-laying as compared with cast-iron." And later is mentioned the well-known advantage that a steel main has a considerably greater carrying power than a cast-iron main of the same size, owing to the comparative absence of friction.

The volume is by no means large; but it is well arranged, and is eminently suitable for the practical man. The book contains 137 pages; and the subject matter is divided into twelve chapters and an appendix. For reference purposes, the chapters have sub-headings in the margin of the pages.

Those interested in the distribution of gas in steel mains will wish to know in some detail the contents of the volume. The authors first deal with the advantages of the steel main as compared with the most generally used cast-iron mains. Next comes a description of the "Rigid" joint—a joint which is bound to find favour with the practical man. The authors give particulars of the severe tests to which this joint has been subjected with perfectly satisfactory results. Whoever finds fault with the steel main, it will not be with the joint here described.

The use of lead wool is strongly advocated in Chapter III., both for cast-iron and steel mains. Few who have used lead wool—or "ribbon" as it is sometimes termed—will disagree with the authors about the comparative merits of cast-lead and lead-wool joints. In a chapter on main-laying, there are given particulars of "specials," plant required for testing—a matter which is deemed of paramount importance by the authors—a list of tools required, and scores of other details likely to be of interest and utility to the reader. Here is explained the way in which a steel main may be bent to a sharp curve, after being jointed together temporarily with iron wedges, by the simple means of pulling it round to the curve required. The long leverage makes this an easy operation. To protect steel mains from rust, it is the invariable practice to cover them completely with jute cloth, having first applied a coat of tar or bitumen solution, to be followed by another coat after the jute cloth has been wrapped round the pipe.

The connection of service-pipes to steel mains obviously cannot be made in the same way as in the case of cast-iron mains. The thickness of metal renders this quite impossible. The authors devote a chapter to the explanation of their expansion nipple for this purpose. The device is exceedingly ingenious, and there is no doubt that it makes a thoroughly sound job. This, as with other matters in the volume, is well illustrated and very clearly described. Next follows a chapter on the W. & P. service joint—another recent design of the authors. Then the question of unaccounted-for gas is discussed, and an attempt is made to apportion to the various causes their respective share in a suggested hypothetical case.

The way "Leakage" is treated is a feature of the work. Full particulars are given of the authors' method, adopting a testing standard of 20 lbs. pressure to the square inch. In a chapter on "Main Testing for Leakage," a very useful account is given of a system of testing the mains of a district in sections. This is somewhat of a digression from the subject of the book, but is none the less welcome to readers, who will appreciate the usefulness of the information.

As the authors point out, in discussing the great importance of thoroughly testing all mains and services after laying them, a leakage of one foot per hour represents a loss of £1 a year, taking gas at 2s. 3½d. per 1000 cubic feet. With this figure firmly rooted in one's mind, the question of the detection of leakage is realized in its full significance.

Several interesting particulars are given of "High-Pressure Distribution" in a chapter devoted to the subject; and the authors have some very useful notes on steel and wrought iron in the last chapter of the book. Included in the appendix are a number of tables referring to the calculation of leakage, and the dimensions of various types of steel mains.

The book being on a subject the experience regarding which is relatively small, gives little scope for criticism of an adverse nature. It is practical throughout; indeed, it is what might have been expected from engineers of the authors' repute.

* "The Gas Engineers' Laboratory Handbook." By John Hornby. Third edition, revised and enlarged. London: E. & F. N. Spon, Limited; 1911. [Price, 6s. net].

† "Distribution by Steel." By Henry Woodall, M.Inst.C.E., and B. R. Parkinson, A.M.I.Mech.E. London: John Allan and Co.; 1911.

Yorkshire Junior Gas Association.—We learn from the Hon. Secretary (Mr. E. Garsed) that the next meeting of the Association—the last of the session—will be held on Saturday, at the Halifax Gas-Works (not at Leeds, as previously announced), under the presidency of Mr. F. Scholefield, of Dewsbury. A paper will be read by Mr. C. D. Cawthra, of Halifax, on "Stopped Ascension-Pipes." This will be followed by a discussion on the whole subject of ascension-pipes and hydraulic mains.

HYGIENIC ASPECTS OF ILLUMINATION, AND PROGRESS IN ILLUMINATING ENGINEERING.

At the Meeting of the Institute of Sanitary Engineers yesterday week—the President (Mr. A. J. Martin, M.Inst.C.E., F.G.S.) in the chair—Mr. L. GASTER lectured on the above subjects, illustrating them by several lantern slides.

In the early part of the lecture, Mr. Gaster observed that almost everyone, whatever his vocation, has to consider the use of light. The school-teacher, the librarian, the shop-keeper, and the business man are all bound to consider with circumspection the lighting of their premises; and the whole nation is intimately concerned with its direct bearing upon health. Sir James Crichton Browne, in an address delivered before the Manchester Sanitary Association in 1902, laid stress on the very close connection between conditions of illumination and general health; and he quoted in this connection the Italian proverb, "Where the sun does not enter, the doctor comes." The truth of this proverb is recognized even more fully to-day. The beneficial effects of free access of daylight in preventing consumption, promoting cleanliness, and generally acting as a destroyer of germs, is being insisted upon by those responsible for factories and workshops. The most recently issued report of H.M. Chief Inspector of Factories in this country lays stress on the evils of badly-lighted underground premises; and employers everywhere are becoming aware that people work better and more cheerfully, and waste less time in sickness, in well-lighted surroundings than they do under conditions which are dim and dismal.

We are accustomed, proceeded the lecturer, to think of light from the standpoint of its use in industry in enabling us to carry on our daily work. But physiologists go further than this. They assert that the ordinary physiological processes of the body, our respiration, the functions of the skin, even our heart-beats, are directly influenced by light. There is also one other point on which comment may be made—namely, the effect of good illumination in promoting cleanliness. In the recently issued report of H.M. Chief Inspector of Factories, he says: "The importance of adequate lighting in industrial employment is obvious—as a matter of safety, especially where dangerous processes are carried on; as bearing upon health in many ways, directly and indirectly; and as a condition of efficient work. On the health side, it is hardly necessary to point out that inefficient illumination entails risk, strain, and ultimate damage to the sight, even apart from interference with work, or that it tends to neglect of cleanliness and adds to the risk of working in poisonous materials, or that it increases the need for artificial light, which can seldom be as satisfactory as daylight."

The lecturer next dealt with the progress in artificial illumination, about which our readers are well-informed; and then he proceeded to show how the eye has been developed to the use of daylight. Step by step with the development of illumination in the last century has been the progress of education and the enormous spread of printed matter. The result is that we use our eyes far more than our forefathers did. And this raises at once the questions: Are we wise in continuing to turn night into day? Is it not possible that the growing brilliancy of illumination by night may not have an unfavourable effect on physical development? that organs which require the occasional cessation of light are unduly stimulated, and that nervous strain may follow? These are questions for the physiologists to study.

There are features in artificial lighting to be guarded against, such as glare, insufficiency, &c., industrial enterprise, and the pursuit of knowledge and pleasure by night continue to demand an increasing use of artificial light. Our first duty, therefore, is obviously (said the lecturer) to secure that this light is wisely applied; and physiologists can confer a great boon by bringing their experience to bear on the matter. The artificial lighting we meet, as often practised, differs radically from daylight illumination in several important respects. The first danger we must guard against in artificial lighting is that of providing too little light. Many defects of vision are to be traced to poor illumination. And is it not possible that many other nervous defects and symptoms of over-strain are due to the same cause? An equally important deviation from daylight conditions in most artificial illuminants is the concentration of the light. The weakness of glare in artificial illuminants has been well recognized by many engineers. But public opinion still requires to be educated as to the wise use of light and the avoidance of glare. Meantime, we require more definite data. What is the minimum brilliancy which the eye can bear without discomfort? How far is the impression of glare due to contrast of bright objects with relatively subdued surroundings? How can artificial lights be best distributed in interiors so as to avoid these defects? These are questions which are already confronting the lighting engineer to-day. Meantime, it has been suggested that it would be wise to tone down, by suitable shades, the brightness of sources of light until the intrinsic brilliance is not greater than that of the average sky—*i.e.*, about 2½-candle power per square inch; and it is also admitted that we should do all that is possible to keep these bright sources out of the normal range of vision. The lecturer added that there have been other suggestions for avoiding "glare." One method of lighting, the so-called "indirect system," has been much praised for its qualities in this connection. There are several respects in which this system, in an extreme form, does not exactly resemble daylight, and the impression of "flatness" or "something wanting" that it produces is unpleasing to people in many instances. Yet going to the other extreme, a very strongly-lighted desk, with very sombre surroundings, is also open to objection. Every time the eye strays from the desk the pupil aperture of the eye and the retina have to adapt themselves to the new conditions, and the continual repetition of this process is very fatiguing. The tendency now is, therefore, to advocate a middle course between these extremes—*i.e.*, moderate general illumination and stronger local lighting from well-shaded lamps in addition.

A line of work that has recently received a considerable amount of attention is the connection between ventilation and the effect of the products of combustion of open flames, gas-burners, and stoves, &c., on the ventilation. Experiments on these points have been made; but the views expressed by different authorities seem inconsistent in some respects, and further confirmation would be desirable. It may be observed, for example, that a very complete and interesting series of researches was carried out by Dr. Samuel Rideal, and published in the "Journal of the Royal Sanitary Institute" in 1908, on the effect of products of combustion of various kinds, on frequency of pulse and respiration, richness of blood in coloured corpuscles, body temperature, mental fatigue, &c., and has provided a most interesting and suggestive record of the possible lines of research in this direction. The questions he studied may be said to have never, apparently, been thoroughly threshed out; and one would like to see confirmatory tests undertaken, especially in view of the well-recognized need for repetition of result in physiological study. Quite recently some tests on the effects of products of combustion have also been carried out by Dr. Toogood, at the Lewisham Infirmary; and it is interesting to observe that in 1908 a special grant was made to Dr. W. Wade for the purpose of carrying out researches on the same point. Such experiments have certainly added to our knowledge of the subject. At the same time, it may be suggested that, in the case of physiological researches of this kind, experiments on a large number of individuals are desirable, and that the repetition of experiments by various observers is also requisite. It is to be noted, also, that in order to carry the necessary weight such tests should be conducted under circumstances that leave no doubt as to their impartiality. The lecturer next laid stress on the value of actual measurements of illumination; and later on he again called attention to the seriousness of inadequate lighting in factories, in view of the accidents occasioned. Public opinion is rapidly becoming educated to the need for greater care in this respect, just as in the case of ventilation and pure air. Good illumination is essential in all industrial operations, if only by reason of the strain thrown on operators by attempting to do their work in a poor light. But it is felt to be possibly even more important that dangerous machinery should be illuminated with sufficient intensity, and with properly placed lamps, so as to reduce the danger of accidents to a minimum. The impression appears to be very general and well-grounded that good illumination is desirable from the standpoint of both employers and employed. Employers will only be too glad to receive guidance on these matters, recognizing that poor illumination, besides involving risk of accident to employees, leads to spoiled work and prejudicially affects quality and output of work. Another aspect of the matter which is not without its appeal to employers is the close connection which may be presumed to exist, and which is already becoming recognized by insurance companies, between the number of accidents that occur and the conditions of illumination. Accidents are doubly inconvenient to employers, both on account of the stoppage of work and interference of routine, and because of the heavy compensation to the injured. They are, therefore, the more willing, when this is pointed out, to bear the relatively small expense needed in order to put the lighting in a thoroughly satisfactory condition.

At the close of the lecture, there were a few remarks in proposing, seconding, and supporting a vote of thanks to Mr. Gaster. The President thanked the lecturer for the impartial way in which he had treated the various aspects of his subject. He thought it the duty of all who had influence to impress upon employers what a real investment it is to have a good light throughout their factories. The employer gains much more than the difference between the cost of good and bad illumination. He spoke of reflected lighting from the ceiling as being ghastly and depressing. He also mentioned that he was responsible for some of the physical work in connection with Dr. Rideal's trials; and he could vouch for the great addition to knowledge that was brought about by his work. Among other speakers was Mr. Justus Eck, who, as a set-off to the injury to eyes by glare, referred to the carbon dioxide evolved by different illuminants. He thought attention should be paid to this in artificial lighting as well as to the effect of glare. The President pointed out—and this is of importance—that it is unfair to take account of carbon dioxide unless one also considers the amount of elimination by removal possessed by the source of production. [There are other points about the carbon dioxide question of which such a student of illumination as Mr. Justus Eck must be fully aware, and of which it would have been interesting to such laymen in illumination as sanitary engineers to have heard while he was speaking. It is certainly not justice to partially treat a subject with the very obvious intention of impressing hearers with the bad character of a competitor's wares.]

MUNICIPAL INCOME AND EXPENDITURE.

Statistics from Annual Local Taxation Returns.

THERE has, compared with past years, been a commendable gain in the matter of the time occupied in the preparation of the series of Local Taxation Returns which are now making their appearance. These are for the twelve months ending March 31, 1909; and though even now the statistics furnished are two years old, the date of their publication marks a great improvement on those of their predecessors—the returns for the immediately preceding year having been noticed in the "JOURNAL" only about four months ago. The volume of the series that may this week be dealt with briefly is Part V., which is devoted to the accounts of the councils of boroughs other than Metropolitan Boroughs for the year named.

The number of boroughs in existence at the end of the year 1908-9, excluding the City of London and the Metropolitan Boroughs constituted under the provisions of the London Government Act of 1899, was 327. Of these, 74 (Merthyr Tydfil was constituted a county borough on April 1, 1908) were county boroughs. The receipts (including transfers from one account to another), other than from loans, which are shown in the abstract of the accounts of borough councils for the year 1908-9—not being the exchequer contribution accounts of county boroughs, nor the accounts relating to tramway, light railway, or water, gas, or electricity supply undertakings—amounted, in the aggregate, to £33,968,183. Of this sum, £19,380,728 was from rates; £27,850, the grant under the Agricultural Rates Act, 1896; £937,051, sums transferred in relief of rates from accounts relating to tramways and light railways and water, gas, and electricity undertakings; and £5,941,784, on account of education. The expenditure (exclusive of that defrayed out of loans, and of exchequer contribution accounts and accounts relating to tramway, light railway, water, gas, or electricity undertakings), including money passing from one account to another of the same corporation, amounted to £34,358,860, including £10,722,488 spent on account of education. Some of the principal items on this side were: Public roads and streets, £5,157,849; sewerage and sewage disposal, £2,363,784; public lighting (including expenditure on public electric lighting not represented by loan charges), £1,212,586; police (not including payments made out of the police pension funds), £1,785,994; scavenging, £1,255,825; salaries, &c., and superannuation allowances of officers, and certain establishment charges, £1,438,688. There were also amounts transferred to make up deficiencies in revenue of tramways and light railways, water-works, gas-works, and electricity works, totalling £331,988.

The expenditure which was charged during the year by the councils, or was intended ultimately to be charged, to loan accounts, excluding expenditure in respect of tramway, light railway, and water, gas, and electricity supply undertakings, amounted to £4,495,331. The individual headings were: Education; public roads and streets; sewerage and sewage disposal works; harbours, piers, docks, &c.; housing of the working classes; parks and open spaces; public offices and buildings; baths, washhouses, and open bathing places; markets; bridges and ferries; hospitals; depôts, stables, wharves, yards, refuse destructors, and works connected therewith; lunatic asylums; and other purposes. The total amount of loans that were actually raised during the year, excluding tramway, light railway, water, gas, and electricity undertakings, and money borrowed under the Education (Provision of Working Balances) Act, 1903, was £5,200,435; while the repayments of principal and the redemption of stock or annuities, and the total sum paid for interest, was £8,017,850. The amount outstanding at the close of the year now under review in respect of the loans owing by councils (excluding tramway, &c., undertakings, but including education) was £125,956,102. Of this, £27,957,827 was for public roads and streets, £20,528,062 for sewerage and sewage disposal works, and £19,588,439 for education. The sums standing to the credit of sinking funds, loan funds, and redemption funds in connection with such of the outstanding loans of the councils as were repayable by means of such funds, amounted at the close of the year to £8,405,238 in the case of county boroughs, and £1,449,054 in that of non-county boroughs.

Referring to statistics in regard to the accounts of councils connected with the undertakings excluded from the figures already quoted—namely, tramway, light railway, and water, gas, and electricity concerns—it is found that the receipts for the year 1908-9 (excluding sums withdrawn from reserve, &c., funds, and sums transferred from other accounts to make up deficiencies in revenue), other than from loans, and the expenditure not defrayed out of loans in the different branches, were as follows: Tramways and light railways—Receipts, including £38,826 received from other accounts of the councils, £5,984,255; expenditure, including loan charges, £5,620,772. Water undertakings—Receipts, including £187,362 received from other accounts of the councils, £4,285,701; and expenditure, including loan charges, £4,338,665. Gas undertakings—Receipts, including £496,006 received from other accounts of the councils, £6,947,301; and expenditure, including loan charges, £6,574,122. Electricity undertakings—Receipts, including £1,149,350 received from other accounts of the councils, £3,704,785; and expenditure, including loan charges, £3,501,616. This gives a total income for the four classes of undertakings of £20,922,042; and an expenditure of £20,035,175. It should be noted that the expenditure excludes sums paid to reserve, &c., funds, and amounts transferred in relief of rates, or to meet deficiencies in revenue of other undertakings; but expenditure out of sums withdrawn from reserve, &c., funds is included.

The total amounts expended by the councils out of loans (or intended ultimately to be charged to loan account), and the total amount of the loans raised by the councils, during the year under review, for the purposes of the various kinds of undertakings now being considered were: Tramways and light railways—Expenditure out of loans, £659,295; and receipts from loans, £993,902. Water undertakings—Expenditure out of loans, £1,305,038; and receipts from loans, £1,281,829. Gas undertakings—Expenditure out of loans, £329,554; receipts, £298,963. Electricity undertakings—Expenditure out of loans, £955,800; and receipts £1,131,450. Thus the total expenditure out of loans was £3,249,687; while the receipts were £3,706,144. The sum applied by the councils in the repayment of principal and the redemption of stock or annuities, in connection with the loans raised for the purposes of the undertakings referred to, was £2,200,744. The total expenditure (including interest and dividends) on account of loan charges was £6,939,309. The loans outstanding were: Tramways and light railways, £22,349,450; water, £61,405,122 (in addition, a sum of £13,033 was owing at the end of the year to capital funds of councils in respect of money utilized in lieu of borrowing); gas, £19,284,887; and electricity, £21,212,817 (in addition, a sum of £15,690 was owing at the end of the year to capital funds of councils in respect of money utilized in lieu of borrowing). These amounts made a grand total of £124,252,276 outstanding in the shape of loans. The sum remaining in sinking funds, loan funds, and redemption funds at the end of the year, to provide for the repayment of the outstanding loan debt, was £6,572,479. The reserve, depreciation, and insurance funds established in connection with undertakings were at March 31, 1909, £4,290,894.

According to the census of 1901 (after taking into account all alterations of area between that time and March 31, 1909), the total population of the 74 county boroughs was 9,748,755, and that of the 253 other boroughs was 4,201,175—making an aggregate of 13,949,930. The total rateable value of agricultural land and other property was £75,317,035. The rates raised during the year by councils of county boroughs averaged 5s. 7·6d. in the pound. In the case of the non-county boroughs, the average was 3s. 8·8d. in the pound where the councils were not the local education authorities, and 4s. 8·3d. where they were. The total amount raised was: In the county boroughs £14,482,517; and in the non-county boroughs, £4,898,211.

The total transfers from the accounts of tramway, light railway, and water, gas, and electricity concerns in aid of rates amounted, as already stated, to £937,051; while there were total transfers from borough, district, or other funds to make up deficiencies in the revenue of such undertakings to the extent of £331,988. The former amount was made up as follows: Tramways and light railways, £285,064; water, £97,965; gas, £453,530; and electricity, £100,492. The deficiencies which had to be made good were: Tramways and light railways, £54,808; water, £234,074; gas, £3053; electricity, £40,053. It will be seen from these figures that gas may be once more congratulated upon occupying the pleasant position of being the most profitable, from a rate-aiding point of view, of the four classes of municipally-owned undertakings referred to; while at the same time it holds the equally enviable position of having by far the smallest amount placed against it under the head of sums transferred from other accounts to make good deficiencies in revenue.

Taking the question of profits more in detail, it may be mentioned that of the gas-works profits transferred in aid of rates in the year under review, the amounts of £10,000 or over were: Birkenhead, £10,027; Birmingham, £65,313; Bolton, £17,500; Burnley, £13,521; Leicester, £34,065; Manchester, £60,000; Nottingham, £31,350; Rochdale, £10,000; Salford, £20,048; Southport, £13,000; Stockport, £15,000; Warrington, £11,862 (including £362 taken out of the reserve fund). In regard to the electric light undertakings also there are some cases in which the profits transferred came to £10,000 or upwards. These are: Liverpool, £20,000; Manchester, £12,000; Nottingham, £11,923. In the case of water-works there are only a few instances of profits being realized. Leeds, however, is credited with £9021 in this connection. All these figures relate to undertakings in the hands of county boroughs.

Coming to the losses, and taking first the very small deficiencies that have to be noted in connection with gas, it is seen that a sum of £2899 was charged at Leigh (Lancs.), this amount representing part of the proceeds of a special general district rate levied the previous year to meet accumulated deficiencies in the accounts of the gas undertaking. Against Morecambe there appears the trifling figure of £154; and these two cases make up the total of £3053 which is stated in the return as the amount transferred, for the year 1908-9, from other accounts of the councils to meet deficiencies in revenue in connection with gas-works. It should be pointed out also that gas was supplied free to the public street-lamps at Oldham, Wigan, Lancaster, and Dewsbury; while at Colne part of the expenditure on street lighting was borne by the Gas Department. With regard to electricity, the story is one of a smaller degree of prosperity. There were in all some thirty cases in which deficiencies had to be met on account of electricity undertakings—the highest amount being £4670 at West Ham; while against Hastings there appears a charge of £3241, Gillingham of

£4040, Morecambe of £2716, and Stafford of £4650. Of the other sums, nine ranged between £1000 and £2000. Turning last of all to water, there are the usual large number of instances in which losses—many of them quite small—were incurred. The water-works deficiencies, in the statistics now under review, which exceed £10,000 are: Birmingham, £65,000; Halifax, £15,933; Huddersfield, £16,831; Swansea, £26,381; and Southport (payment to the Joint Water Board), £10,029.

NATIONAL PHYSICAL LABORATORY.

Annual Report.

THE report of the Executive Committee of the National Physical Laboratory for the year ended Dec. 31, which was submitted to the General Board at their meeting on the 17th ult., was issued last Wednesday. It is accompanied by a statement of the work proposed for the current year; a list of papers published under the authority of the Laboratory during 1909 and 1910, or communicated by members of the staff to scientific societies or institutions or to the technical journals; and the report of the Director (Dr. R. T. Glazebrook, F.R.S.) for the past year. From this we extract the following particulars.

The work in connection with electrotechnics, including photometry, during the year 1910 was about equally divided between testing and investigation. With regard to photometry, it is stated that the agreement with the laboratories of other countries on the question of the unit of light rendered the international comparison of standards and sub-standards a matter of less urgency during the past year, and there was consequently more time to continue the work of reproducing the existing unit by the establishment of new series of sub-standards. These are used more and more as working standards, relieving the original standards of all but special reference work. The progressive tendency towards the use of lamps of higher efficiency further reduced the extent to which standards of this nature have to be employed; and during the past year they remained almost untouched. Some spectro-photometric investigations were made in connection with the reproduction of the pentane unit in light having a whiter hue.

There was a considerable increase last year in the amount of work done in connection with thermometry, including a continuation of the work on the fundamental high temperature scale. The immediate object of the research is to prolong to high temperatures the gas thermometer scale; and for this purpose it is proposed to use reservoirs and tubes made of extremely refractory rare earth materials, rendered gas-tight by a special process. The study of the difficulties met with in baking these materials took up a considerable proportion of the time available; but with the improved facilities now at disposal, it is hoped that material progress with the investigation will be made in the near future. In order to elucidate the causes of the chemical changes brought about under certain circumstances in the tubes made of rare earths introduced into the furnace for baking, it was necessary to make a systematic study of the physical phenomena of the electric carbon resistance furnace at very high temperatures. This general study of the furnace has yielded a number of results of great interest, which it is hoped to publish very shortly.

In the Engineering Department, some work was done last year in connection with the heat transmission and friction of air currents in pipes. It was confined entirely to investigating the dimensional effect of the pipes on the friction. For this purpose, the relation between frictional resistance and velocity for three pipes of different diameters was determined, together with the corresponding variation in mean axial velocity of the current in a radial direction. The results of the latter experiments were to confirm Mr. Threlfall's discovery that for a given pipe the law of distribution of axial velocity over any section is independent of the rate of flow, provided the section of the pipe at which the velocity is measured is sufficiently far from the origin of the pipe.

Another matter dealt with in the Engineering Department was the resistance of different forms of screw-threads to shock. At the request of the Screw-Threads Committee, a research was carried out on the relative resistance of four forms of screw-thread to shock. The forms chosen for experiment were the British standard fine, the British standard Whitworth, the United States standard or Sellers' thread, and the United States "Vee" thread. The two former have an angle of 55°, and the latter an angle of 60°. The shock tests chosen were to subject the screws to impact from a falling weight so arranged as to put the specimen in tension and in shear. It was also decided to make torsion tests on all the screws, as well as the ordinary statical tensile tests. The results of the tests conclusively proved the superiority of the British standard fine thread, under the conditions of the tests, for both hard and soft steels.

With regard to the financial position of the Laboratory, the income last year was £28,076, compared with £24,270 in 1909; but the expenditure exceeded the revenue by £222, amounting to £28,298. The Institution of Civil Engineers continued their subscription of £500 for engineering research, and the Institution of Mechanical Engineers theirs of £200 for alloys research; while among the contributions was £10,000 from Sir Julius C. Wernher, Bart., for the metallurgy building.

ROAD IMPROVEMENTS AND TAR.

EVERYTHING appertaining to roads, whether it be their construction, foundation, surface covering, or traffic over them, is bound to be of interest and concern to the modern gas engineer. His work of laying gas-mains may be fundamentally altered by the rapidly changing conditions of roads and road traffic. Questions of pipe foundations or of pipe depths cannot really be determined without taking into consideration the manner of the construction of the roads, or the nature of the traffic.

The innovations caused by the somewhat sudden introduction and adoption of mechanically propelled vehicles of all kinds have undoubtedly affected the gas engineer, and particularly the distributing engineer—first, as regards the cost of his main laying, and, secondly, as to the opportunities offered to him for a further outlet for the disposal of his tar. The present period in road making and management is a transitory one; and it therefore behoves those concerned in the gas-industry to see that bye-products that they may have to offer to the road authorities are suitable for the purposes for which they are tendered, and, further, that nothing is done by such authorities as may tend to handicap in the future the use of gas-works tar. Here, as in many other instances, there is need for a vigilant centralized supervision to guard the best interests of the gas industry.

Such observations as these are suggested by the reading of two papers, on the 4th inst., at the Institution of Civil Engineers, which were discussed last Tuesday at the ordinary weekly meeting of this body. One paper was a long and exhaustive one of some fifty pages by Mr. J. Walker Smith, M.Inst.C.E., under the title of "The Improvement of Highways to Meet Modern Conditions of Traffic." The other paper was by Mr. H. P. Maybury, M.Inst.C.E., and dealt with "Recent Development in Road Traffic, Road Construction, and Maintenance." The author of the former paper comments at the outset on the changing conditions of traffic, the increasing cost of road maintenance, and the necessity of improved treatment. Formerly about 95 per cent. of the 180,000 odd miles of roads in England and Scotland were of the water-bound macadam type. The problem dealt with by the paper is how best to convert such portion of these roads as may be required from the water-bound or aqueous type to the bituminous method of construction. It has been found that the adoption of the latter method has already mitigated the dust nuisance, and has had beneficial financial results. The author suggests that data should be collected with a view of the standardization of bituminous binders, road metal, methods of construction, and costs. He proceeds to the consideration of the methods of construction of bituminous-bound roads, which may be divided into those formed of tar macadam and those treated with bituminous grout. The details of the construction of roads by either of these methods need not be given here; suffice it to say, in the author's opinion, the latter method of tar grouting, if properly done, cannot fail to give complete satisfaction.

The advantages and disadvantages of such roads are next considered. The essence of the matter appears to lie in the efficiency of the binding and in the firm holding of the stones up to their work. A lower quality of stone can be used with tar than in a water-bound road, provided the top surface is good. Perhaps, also, less impervious stones might be treated with creosote oil, so as to fill up their pores, and thus prevent atmospheric oxidizing. Tar-treated roads effect economies in scavenging, repairs, and watering. A typical instance is cited by the author of a tar macadam road subject to heavy traffic, which only needed slight attention after three years, and of another experimental section which, after five years, required nothing but patching and surface tar washing.

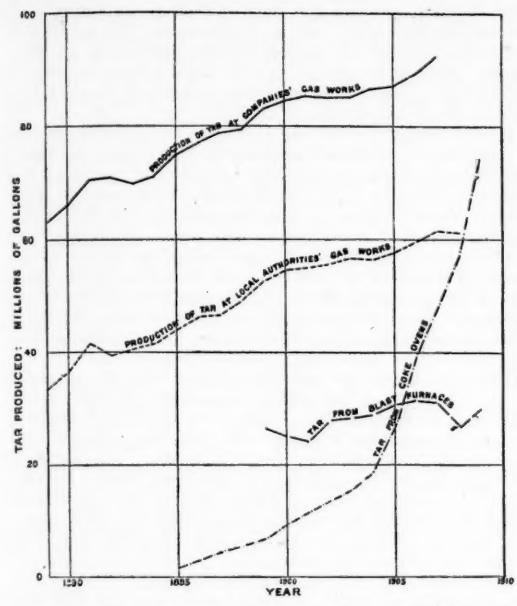
In watering, from 50 to 60 per cent. can be saved by the use of tar roads. Other advantages are imperviousness, density in the distribution of weight, and in being able to adopt a flatter camber, besides which there is less noise, less tractive effort, and improved hygienic results. Several diagrams and appendices are given in the paper illustrating and explanatory of these details.

The disadvantages of the system may be summed up thus: Increased first cost, less foothold on gradients, slipperiness due to frost, and the necessity of favourable weather during construction. The last-named is not, however, so important with tar concrete as with grouting.

The author next deals with the materials used, and considers the destructive agencies, whether physical, mechanical, or chemical. He refers in some detail to the investigations of other engineers, and particularly to the attrition tests of Mr. E. J. Lovegrove, M.Inst.C.E., Dr. Flett, and Mr. Allan Howe. Bituminous binders are divided into: (1) Natural asphalts and petroleum residuals; and (2), tar products.

The author gives a diagram (reproduced) showing the production of tar in Great Britain. About 50 per cent. more would be available if all coke-ovens adopted the recovery process. The author thinks that if 50,000 miles of road were reconstructed with tar within the next twenty years, not more than 14 per cent. of the total production would be used, and therefore, in his opinion, the price of tar is not likely to be much higher through its use for roads.

Early mistakes in the employment of tar macadam were due to ignorance of the properties of tar and to the wide variation in it.


TAR PRODUCED: MILLIONS OF GALLONS
YEAR
PRODUCTION OF TAR AT COMPANIES' GAS WORKS
PRODUCTION OF TAR AT LOCAL AUTHORITIES' GAS WORKS
TAR FROM BLAST FURNACES
TAR FROM COKE OVENS

Tar from the same gas-works varies because of differences in carbonizing temperatures, retort shapes, pipes, quality of coal, and condition of tar-tanks, &c. Diagrams are given in the paper showing the results of distillation of various crude tars, the specific gravities of which were as follows:—

Blast furnace	1·068
Carburetted water gas	1·085
,, ,,	1·088
Coke-ovens (Wigan)	1·150
Coal gas (Burnley)	1·165

The qualities of a good bituminous matrix are next considered, among which are the power to resist volatilization and penetration by superimposed weight. It seems likely that to some extent the latter quality may vary with the percentage of free carbon; and the effects of free carbon are discussed in the paper. An appendix gives a description of laboratory tests for tar, and in another are suggested specifications for tar, from which the following particulars are taken:—

—	Moderate Tar.	Heavy Tar.	Soft Pitch.
The tar shall be obtained from gas-works or coke-ovens. When obtained from gas-works, it shall be that derived from bituminous coal, but an admixture of 10 to 15 per cent. of that derived from the carbonization of oil shall be permitted.			
The specific gravity at 15° C., as determined by a tar specific-gravity bottle, shall be—			
Approximately	1·195	1·220	1·278
Not exceeding	1·205	1·230	1·290
And not less than	1·185	1·210	1·265
On distillation (the bulb of the thermometer to be placed in the vapour at a point where it enters the side tube of the distillation-flask) its percentages of yield of distillate shall be limited thus—			
Below 210° C.	—	—	—
,, 280° C. not more than	10	7	3
,, 350° C. ,, ,,	35	25	18
It shall not contain a larger percentage of naphthalene than	7	6	5
It shall not exceed in free carbon upon basis of percentage in weight	15	17	18
Upon ignition it shall not show in inorganic residual a larger percentage than	0·5	0·5	0·5
It shall not lose by volatilization, exposed for one week at 60° Fahr., in a thickness of ⅛ inch, a larger percentage by weight than	2	1·5	1
With the residue from the last test exposed for a second week at 110° Fahr., it shall not lose by percentage of its weight more than	8	3·5	2

It was at first considered advisable by the author to reject tar from carburetted water-gas plants; but, because of difficulties of separation, this was not insisted upon. The specific gravities of the tar specified will vary between that produced in the North and South of England; and adjustments in the specifications can be made accordingly. Freedom from water ensures a refined tar, and avoids difficulty with frothing when tar is being heated.

Questions of cost are gone into by the author, and rather elaborate tables are given in the paper relating to it and in regard to maintenance, repairs, and road records.

Mr. Maybury's paper is a short one. He points out that the first element of success is a good foundation. Complaint is made of the damage done to roads by the heavy commercial motor. Gas-works tar was at first used for dust prevention, when it was found that, incidentally, its use had lengthened the life of the road. Mr. Maybury says that "in the use of tar and its products lie the practical and financial possibilities of improvement in the immediate future." He is in agreement with the author of the previous paper as to the need of standardization and of specifications; but he points out that sufficient information is not yet forthcoming on which final specifications for the supply and use of tar could be based. Tar spraying or painting can be successfully carried out; but there must first be a good surface, which must be dry and clean. All volatile oils and phenoloid matters must have been removed from the tar, which must not have any large quantity of naphthalene or free carbon. It should be free from water—that is, it should not contain more than 1 per cent. by volume of water or ammoniacal liquor. It should be put on the road as hot as possible.

The discussion upon these interesting and important papers was adequate as far as it went; but, as so often happens, it was greatly curtailed for want of time. It was pointed out that the character of the traffic had to be considered as well as the weight of it, besides which the effect of speed with solid-tyred vehicles was an important element in the wear and tear of roads. One speaker stated the defect of tar to be the varying degrees of viscosity, its volatilization at ordinary temperatures, and the loss of tensile strength at high temperatures. More uniformity and stability in tar were required before one dogmatized about its use. Native bitumen had a regular consistency. Sir George Gibb, the Chairman of the Road Board, stated that it must now be taken that the general principle of the use of tar was agreed upon, and that the task was the accumulation of data and its scientific application. "Maintenance," he thought, was a misleading term, as it was made to include both renewals and repairs. Uniformity in terms and comparisons was essential.

Mr. W. J. A. Butterfield referred to the quantity of tar that would be required if Mr. Walker Smith's proposal for reconstructing English roads with tar macadam were carried out. If no other supplies were forthcoming, the proposal would use up one-half the tar from gas-works; leaving nothing for Ireland, Scotland, and for surface treatment. By Mr. Maybury's alternative method of surface coating, four or five times the amount of road surface could be done than by the bituminous macadam system. The speaker thought that tar should be husbanded, using it only for roads that were subjected to heavy traffic. Colonel Crompton showed an interesting diagram illustrating the cost of repairs and its variation with the amount of traffic. Time did not allow of the authors replying to the discussion, so their observations upon it will be delayed until the publication of the minutes of proceedings. They were congratulated upon their valuable contributions to a subject of general and increasing importance.

KLÖNNE CHAMBER OVENS FOR GAS MAKING.

At the recent Annual Meeting of the Illinois Gas Association, a paper on "The Klönne Chamber-Oven Process of Coal-Gas Manufacture" was presented by Mr. Joseph C. Markley, of Chicago. For the purpose of making observations and becoming familiar with the process, the author visited a number of works in which it is employed; and in many cases he was allowed to have access to records, so as to obtain data in regard to working conditions. It may be remembered that the Klönne process was the subject of a paper read by M. Paul Parsy at the last meeting of the Société Technique du Gaz en France; and in the translation of it given in the "Journal" for June 28, 1910, particulars will be found of some of the installations referred to by Mr. Markley, whose paper is summarized below.

The Klönne process as at present in use has been developed from an experiment made in 1892, when the well-known Dortmund firm built a setting of inclined ovens designed for carbonizing 5 tons of coal in each chamber in 24 hours. This installation did not, however, produce the results expected; and it was abandoned. The first horizontal chamber oven was erected at the Oost-Zeedyke Gas-Works in Rotterdam in 1908.* An extension of this plant, consisting of ten horizontal ovens of four chambers, was in course of construction at the time of Mr. Markley's visit. He also inspected the installation of six inclined ovens at Königsberg, the setting of a vertical oven at Dortmund, and horizontal ovens at the Rixdorf works (Berlin), at Frankenthal (Bavaria), Brussels, and Padua; besides which there is an installation of two ovens at Versailles. The special features of the process as finally developed include: (1) Carbonization of the coal in bulk and saving in ground space. (2) Saving in labour and elimination of night work, excepting for firing the generators, which is done every six hours by one man. (3) Moderate heats, with attendant saving in maintenance cost. (4) Elimination of stand-pipe troubles and pitch in the hydraulic main. (5) Good yield and heating value of gas, with freedom from carbon deposits in the chambers. (6) Liquid tar, low in carbon. (7) Mechanical means of regulating texture of coke.

Before dealing with these points in detail, the author gives the following description of the ovens: They are built to contain two, three, or four chambers each; and these vary in length from 14 ft. 9 in. to 19 ft. 8 in. The inside height is about 6 ft. 6 in., and the width

* An illustrated description of the installation was given in the "Journal" for Dec. 29, 1908 (p. 902).

16 inches. The charge per chamber is from 4 to 5 tons of coal, which may be carbonized in from 18 to 36 hours, depending upon the demand for gas. The capacity is based on a carbonizing period of 24 hours, which makes the system sufficiently elastic to meet the changing conditions of output.

In operation, the coal is crushed (when necessary) and conveyed to the bunker built over the ovens, preferably at one end of the stack. The chambers have two or three (depending upon their length) self-sealing charging mouthpieces on top, through which the coal is charged from overhead hand-travelling hoppers; the coal being spouted into these hoppers from the bunker. One man on top of the ovens attends to the opening of the mouthpieces and the charging of the coal. On the operating floor in front of the ovens is an electrically driven travelling machine worked by one man. This machine performs three functions—opens the front door of the chamber, levels the coal in it after it is charged, and then pushes out the coke after the carbonizing process is finished. The complete process of discharging the coke from the chambers and recharging with coal requires from 12 to 15 minutes for each chamber. After carbonization, the coke lies in the chamber in the form of a huge block, with an open space of about an inch next the side walls of the chamber. When pushed out by the machine, the mass of coke splits vertically in the centre, forming two sheets or slabs about 7 inches thick, and when it falls on to the quenching floor it breaks up into long pieces.

Clinkering is done every second day—*i.e.*, once every 48 hours. One man does the work, and it requires about an hour for each fire. At the Rixdorf works, the question of scurfing the chambers came up for discussion, and a demonstration was made that was somewhat out of the ordinary. Practically all the carbon forms on the floor of the chamber, though instances were noted where a slight deposit had formed on the side walls. A chamber was selected which had been in continuous operation for eight months, and the carbon on the bottom varied in thickness from about 1½ to 2½ inches. An ordinary garden hose was brought into play, and the floor of the chamber was flooded with water until it became black. Scurfing-bars and sledges were used; the work being done at both ends of the chamber simultaneously, until the bottom blocks came up to heat again, when more water was applied. The entire operation was completed in three-quarters of an hour. In discussing this process later with the builders of the ovens, the Chief Engineer did not discourage the practice, but at the same time said he did not recommend such heroic treatment. Later advice received by the author from the engineer was to the effect that, though the practice of pouring water on the floor of the chamber was still continued, the quantity used was not so great as formerly. A long pipe, with small staggered holes drilled in the under side, is now introduced into the chamber, and the water is applied to the floor in the form of fine spray.

In rare instances, a carbon deposit on the side walls may interfere with the discharge of the coke from the chamber, though only one such case was noted during the six weeks spent on the works. In this case, the pusher could not start the coke after several trials. The chamber was then left open until the next was discharged; and during the 15 minutes sufficient air was admitted to burn the outer surface of the coke next the chamber walls. The coke was then easily discharged. The carbon deposit was then removed from the side wall in a few minutes.

The various advantages of this system of coal gas manufacture were brought out at the different works, and the several engineers were without exception, very enthusiastic indeed over their results. Among the points observed particularly were the following.

(1) *Carbonization of Coal in Bulk.*—This practice seems to be the tendency of late years. Even with horizontal retorts there are recent instances of better results being obtained by the use of heavier charges of coal and longer periods of carbonization; the object being to prevent the bulk of the gas remaining in contact with the highly heated surface of the retort. In the Klönne type of chamber oven, the top part of the chamber is the coolest. The furnace gases flow upward in the vertical flues, at either end of the chamber, to the top level of the charge and then take a downward course at the centre, as shown in fig. 1.

(2) *Low Cost of Carbonizing Labour.*—The question of handling the coal to the overhead bin and the removal of the coke to the yard naturally depends upon the type of coal and coke handling machinery adopted. The handling of coke is more of a problem with the use of chamber ovens than with retorts, due to the large quantity of coke discharged at one time; but it can be easily handled by building the quenching floor on an incline in the form of one big pocket, with smaller shoots extending below the bottom level of the quenching floor. These shoots may then be emptied at leisure. At all the works visited, the coke was quenched with a large fire hose, though various forms of quenching-machines have been designed by the manufacturers of the ovens.

The actual labour for carbonizing the coal is performed during one shift of eight or ten hours, depending upon the size of the plant and the time of day selected for the richest make of gas. At night one man only remains with the ovens; and it is his duty to charge the furnaces once every six hours. Three men on the day shift can readily handle 24 chambers, with a carbonizing capacity of 120 tons of coal per 24 hours. An extra man every second day would be required for clinkering the fires. The same number of men is necessary for a plant of less capacity; but for one carbonizing 60 tons per 24 hours, the men would be able to handle the coal to the overhead bin and the coke to the yard, provided, of course, the necessary coal and coke handling apparatus were provided. In Frankenthal, Sunday labour at the gas-works is practically dispensed with. This, however, is due to the large amount of gas sold to the refiners of precious metals who shut down on Sunday; and the domestic gas demand can be supplied from storage.

(3) *Moderate Heats, with Attendant Saving in Maintenance Cost.*—The temperatures observed ranged from 1900° to 2140° Fahr.; only one of the several works using the higher temperature. The massive construction of the chamber ovens, considered with the fact that very little scurfing of carbon is required and that only on the floors of the chambers, which are built of blocks about 16 inches thick, would give promise of long life. Coke-ovens built on similar lines have been in continuous operation for six years before renewal of carbonizing chambers was required. The coke-pushing machine is of very simple design and heavy construction, indicating low cost of repairs. The remaining portion of the mechanical auxiliaries—such as charging-hoppers and machine for handling discharge doors—have very few moving parts to cause wear.

(4) *Elimination of Stand-Pipe Troubles and Pitch in the Hydraulic Main.*—No troubles of this nature were observed; and the author was informed by several engineers that they did not occur. However, an auger is used in the stand-pipe, the same as in retort practice; a hand hole for the purpose being provided at the lower end of the ascension-pipe. The tar drawn off from the bottom of the hydraulic is quite thin; the absence of pitch being due to the moderate heats.

(5) *Good Yield and Heating Value of the Gas.*—The average yield per pound of coal from the chamber ovens is not particularly remarkable, excepting when the quality of coal in Germany is considered. English coals are used to a great extent, and often mixed with German coals; the former being a trifle less in cost. These coals contain from 27·5 to 33 per cent. of volatile matter. The author was impressed with the uniformity of the average yield at various works. In the case of the Padua plant, the average yield, corrected, for a period of seven months during 1910, was

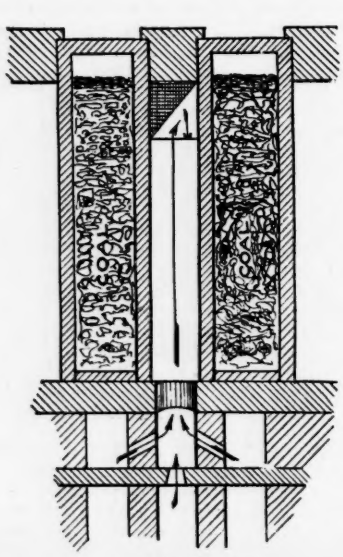


Fig. 1.

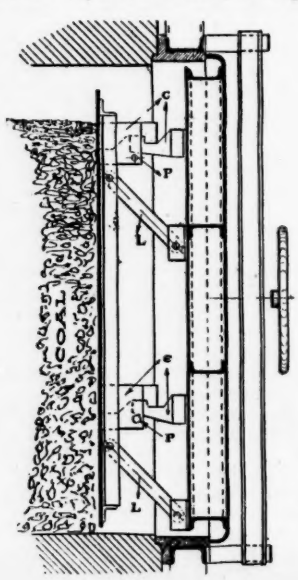


Fig. 2.

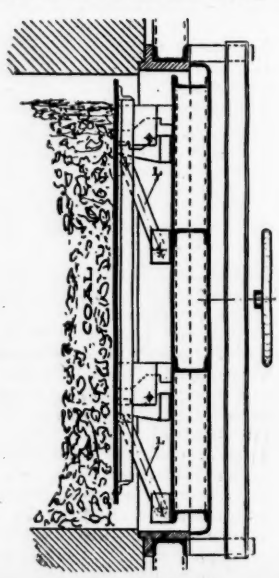


Fig. 3.

5·14 cubic feet per pound of coal, compared with a yield of 4·46 cubic feet during the same period in the previous year with horizontal retorts and the same grade of coal. The coal used was a mixture of New Pelton and Holmside—English coals of 32·2 to 33 per cent. volatile matter. At the Rixdorf works, using a mixture of English coals (Lambton and Hebburn) and Dubensko coal, from Silesia, the yield for July, 1910, was 4·956 cubic feet per pound corrected. The volatile matter contained in these coals is something less than in the New Pelton and Holmside coals—viz., Lambton, 27·5 to 29·95 per cent.; Hebburn, 29·9 to 31·8 per cent.; Dubensko, 33·35 per cent. The proportions of the mixture were 75 per cent. English and 25 per cent. German coal. Very little attention is paid to the candle power of the gas at any of the works; but its calorific value is watched very closely, even in the smaller plants.

(6) *Liquid Tar, Low in Carbon.*—The analysis of a sample of tar, of 1·1359 sp. gr. at 68° Fahr., obtained at the Rixdorf works, and submitted to an American chemist, was as follows:—

	Per Cent.
Water	2·0
Free carbon	3·3
Tar acids	6·1
Naphthalene	7·6

The free carbon is very low for a coal tar; while the amount of tar acids is moderate, and that of solid naphthalene only fair. The residue is an excellent pitch; and being 54 per cent. of the whole, the result is that from 45 to 46 per cent. of the tar can be distilled, and a good quality of pitch remain.

(7) *Mechanical Means of Regulating the Texture of the Coke.*—An ingenious device is employed in the construction of the front and back lids of the chambers, which permits of controlling the hardness of the coke to meet the demands of the market. The arrangement, shown in figs. 2 and 3, consists of an inside shield, which is hinged to the lid or door by heavy links L. When a very hard coke is desired, pins P are inserted under the latches C, which compel the shields to remain stationary—thus exerting pressure on the coal when it begins to expand. Should a soft coke be desired, the pins are not inserted, and this permits the shields to ease-back with the full expansion of the coal, as fig. 3. There is also provision for allowing the shields to give but part way with the expansion of the coal; thus exerting somewhat less pressure than in the first instance, and producing a coke of medium hardness. This arrangement is shown in fig. 4. It consists of a cast-iron block A, which may be inserted under the top latch C, and held in place by a pin B. When the coal has expanded to a certain extent, and the shield is pushed towards the lid or door, the block A comes in contact with the latch D, and consequently it cannot move any farther. Pressure is then exerted on the coal as it continues to expand.

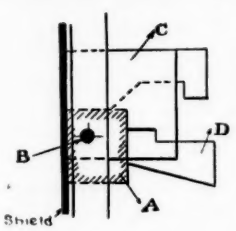


Fig. 4.

Some interesting observations were made by the author at the Padua plant last August, in company with Dr. Ott, of the Zurich works, and Herr Westhofen, of Dortmund, with the following results:—

Holmside coal charged	70,560 lbs.
Gas produced, corrected	351,840 cub. ft.
Do. per pound of coal	4·98 ,,
Average heating value, gross	633 B.Th.U.

In bringing his paper to a close, the author said the result of his investigations suggested the thought that there are possibilities for the chamber-oven process in America in utilizing local coals, or at least a mixture of local coals with Youghiogheny or Pocahontas coal when a better grade of coke is desired. He considered that with Youghiogheny coal only, better results should be expected than are being obtained abroad, due to the higher percentage of volatile hydrocarbons contained in it, compared with German and English coals.

An incident in the early life of the late Sir George Livesey is recorded in the first of a series of articles, entitled "Biographical Bypaths," in the April number of the "Co-partnership Journal" of the South Metropolitan Gas Company. The article is devoted to a notice of Mr. Thomas Farncombe, who was Chairman of the Company from 1840 to 1859—having succeeded Mr. G. Holgate Foster, who had filled the position from the commencement of the Company. He was Lord Mayor (the only Chairman of the Company to be London's Chief Magistrate) for the year 1849-50, immediately before the Great Exhibition of 1851, a good view of which is given in the article. The reference to the boyhood of the late Chairman of the Company is towards the end, where it is recorded that at the Board meeting on Jan. 1, 1850, it was resolved that "Master G. T. Livesey be appointed assistant in the Company's office." The writer of the article—Mr. Walter T. Layton, the Editor of the "Journal"—points out in a foot-note that Sir George on more than one occasion mentioned an earlier date than the one given as the commencement of his service with the Company; and he says no doubt the lad was for some time engaged in the office at a weekly wage, and the resolution referred to formally appointed him to a position on the office staff.

MEASUREMENT OF HIGH TEMPERATURES.

A paper was read by Mr. C. T. Heycock, F.R.S., at the meeting of the London Section of the Society of Chemical Industry on Monday, the 3rd inst., with Mr. E. Grant Hooper, the Chairman of the Section, presiding, on "The Measurement of High Temperatures." The following is an abstract of the paper.

After a brief reference to the early pyrometer of Wedgwood, the author shortly described the iodine thermometer of Deville and Troost, which was mainly of scientific interest and exacted great care in working, and involved errors which, at the time of its introduction, had not been realized. He next referred to the air or gas thermometer which, he said, in the hands of Callendar, Harker, and Griffiths, had been employed with remarkable skill and was the ultimate standard of reference in all thermometry. Those, however, who had used the air thermometer, while realizing its great scientific importance, would not willingly resort to it, owing to the great difficulties involved in its manipulation and use. The next method to which the author referred was the calorimetric method in which a known weight of platinum or other material, of which the specific heat was known, was placed in the furnace of which the temperature was to be measured, and, after it had acquired the temperature of the furnace, was transferred as quickly as possible to a calorimeter. The measurement of the heat by the calorimeter, together with the known mass and specific heat of the body, afforded a means of calculating the temperature to which the body had been raised in the furnace; but there was the inevitable loss of heat in transferring the body from the furnace to the calorimeter. Nevertheless the method had been, and still was, largely used industrially. Mercury thermometers, even when filled with nitrogen, were only available up to a temperature of about 400° C., owing to the softening and distortion of the glass which occurred above that temperature.

The more modern methods of pyrometry described by the author were those dependent on: (1) The alteration of resistance of a wire to an electric current; (2), the alteration of the electromotive force of a thermo-couple; and (3), radiation. The first electrical resistance pyrometer appeared to have been devised by Siemens and described by him in the proceedings of the Royal Society in 1871. Some changes were made by him in it; and the altered instrument was described in the report of the British Association for 1874. The initial difficulty in the use of a resistance pyrometer lay in the resistance of the leads which were more or less heated by the furnace to which the pyrometer was applied. Siemens got over the difficulty introduced by the resistance of the leads by employing an additional pair of wires by which the resistance effects were neutralized in the readings obtained. Callendar, in 1887, improved the Siemens pyrometer by winding the platinum resistance wire round a crossed serrated mica frame or scaffold, and by employing compensating leads in connection with it. The formula for the resistance pyrometer was based on the difference in resistance at the temperatures of 0° C., 100° C., and that of the boiling point of sulphur. The difference between the resistance at 100° C. and at 0° C. was known as the fundamental interval (FI); and it was convenient to make this equal to 1 ohm if possible. The formula was then $T - P_t = \delta\left(\frac{T}{100}\right)^2 - \frac{T}{100}$.

Taking the boiling point of sulphur $P_{ts} = \frac{R_t - R_o \times 100}{FI}$, the value of δ was usually 1·5. The determination of the boiling point of sulphur had been under revision. Callendar and Griffiths took it at 444·5° C., but afterwards 445° was believed to be right, though finally a value of 444·7° was accepted. The exact determination of this boiling point was of extreme importance because the calibration of the resistance pyrometer depended upon it. The following figures showed the kind of values which were obtained:

P_t.	$T - P_t$.	Deg. C.
− 100 ..	+ 2·9 ..	− 97·1
+ 200 ..	+ 3·1 ..	203·1
+ 1000 ..	+ 197 ..	1197
+ 1300 ..	+ 416 ..	1716

The accuracy of the resistance method of pyrometry for high temperatures had recently been demonstrated by comparison with the air thermometer up to a temperature approaching the melting point of platinum. In order to show the accuracy of the resistance method, the author quoted the following figures, which he obtained in collaboration with Mr. Neville in 1875, and the latest determination of the melting points of various metals:—

	Latest Figures.	Neville and Author (1875).
Tin	231·9 ..	231·7
Lead	327·4 ..	327·7
Antimony	630·7 ..	629·5
Silver	960·9 ..	960·7
Copper	1083 ..	1080·5
Nickel	1452 ..	..
Platinum	1755 ..	..

There was little difference between the latest figures and those of 1875. The difference in most cases could be traced to alteration in the accepted temperature for the boiling point of sulphur.

The alteration of the electromotive force of a thermo-couple did not present such an accurate method for the measurement of temperature as did the alteration of the resistance of a wire. Nevertheless the use of thermo-junctions was very general, and

in most practical cases the results were sufficiently accurate. The commonest was that of platinum and platinum-rhodium (90 per cent. of platinum with 10 per cent. of rhodium). Iridium must not be used for high temperatures. Copper and copper-constantam (60 per cent. of copper and 40 per cent. of nickel) or iron-constantam were useful for lower temperatures. The objections to the thermo-couple method were that it was not so easy to measure slight differences of electromotive force as slight differences of resistance, and that platinum, for some not well-understood reason, was injured by exposure to iron surfaces. The thermo-junctions for pyrometry should in any case be standardized against metals of known boiling point, and the results plotted, in order to give a curve for the intermediate readings.

The advantage of radiation methods of pyrometry was that the pyrometer was entirely outside the furnace. The Féry radiation pyrometer, of which there were two types, was the best known. In one type a mirror reflected an inverted image of the source of heat on to a delicate thermo-junction. This was, for reasons explained, independent of the law of inverse squares and gave concordant results even though the distance of the pyrometer from the source were varied. The other type of Féry's radiation pyrometer had a Brévet's spiral in place of the thermo-junction. The optical method was now largely used in industries, as, for instance, for the measurement of the temperature of baths of molten steel. Its accuracy had been demonstrated by Greenwood in a paper in the "Proceedings" of the Royal Society, 1909 (Vol. LXXXII. A). He had found by it the following figures for the boiling points of metals: Antimony 1441° C., bismuth 1420° C., aluminium 1800° C. chromium 2200° C., and copper 2310° C.

The author drew attention to specimens of the various types of pyrometer which he had on the lecture table; and the Chairman then invited discussion of the paper.

Mr. C. R. Darling pointed out that the resistance pyrometer had been modified at an early date by Siemens, who surrounded the platinum wire by magnesium oxide. This modification gave satisfactory results, and was still made and largely used. He thought the author had given the resistance pyrometer more than its proper meed of praise; for there were many objections to it for practical use which did not apply to thermo-junctions. Resistance pyrometers altered considerably if kept for any length of time at a temperature over 1000° C. Thermo-junctions deteriorated, but so also did the platinum resistance. It might be mentioned that the resistance pyrometer had been abandoned at Woolwich Arsenal in favour of thermo-couples, which had the advantage that the measurements of temperature of a number of furnaces in different places could all be watched from the manager's office. Resistance pyrometers were now made which gave direct readings; but the thermo-junction was more easily repaired. In regard to radiation pyrometers, the form of the Féry instrument with the Brévet spiral possessed a curious quality in that the pointer moved and came to a standstill; but with the temperature remaining unaltered it afterwards moved on farther. It was, therefore, uncertain which reading ought to be taken. The reason for this baffling effect had not yet been made out. The Féry instrument, with the thermo-junction, had not this defect. The speaker had recently compared two pyrometers—one of the Holborn type, made by Siemens and standardized at the National Physical Laboratory, and the other a Féry, standardized at the Reichsanstalt—and had found that at 1500° C. they gave identical readings. It was very satisfactory to know that such close agreement existed between different instruments in measurements of such high temperatures.

Dr. Philip raised a question as to the effect of variations in the value of δ in resistance pyrometry on the accuracy of the results. The value of δ depended largely on the quality of the platinum.

Dr. Lessing said he was surprised that the author had made no reference to the use of Seger cones for determining furnace temperatures, as they were still largely employed in certain industries. He would like to hear from the author to what extent radiation pyrometers were affected by the interposition of glass or mica windows.

Dr. Hopkinson thought the author had not given adequate recognition to the thermo-couple. It was the only pyrometric method which afforded records of the results obtained, and was on this account invaluable in works. Rhodium, however, was subject to attack by carbon compounds.

Mr. W. J. A. Butterfield pointed out that the limitation of the range of the mercury thermometer, filled with nitrogen, to a maximum of 400° C. by the author was scarcely fair to it, as these thermometers were now made of resistance glass with the scale extending above 550° C. This extension of their range was most valuable; and he had found them accurate. The glass used was boro-silicate glass.

Mr. Heycock, replying to the discussion, said that he had not intended to be unfair to the thermo-couple method, which was fully dealt with in the paper itself; but for want of time he had been compelled to pass it over rather briefly in the digest of the paper which he had presented to the meeting. For scientific researches, however, the resistance method was preferable. In regard to Dr. Philip's inquiry, different values of δ made little difference to the result, as the following figures, some of which he believed had been obtained by Dr. Philip, showed:—

δ	1·574	1·500	1·530	2·04	1·55	1·51
Degrees C.	1061·5	1061·8	1062·3	1061·2	1061·9	1062·0

There should certainly be no glass or mica window in a radiation pyrometer. If anything were necessary, it should be of rock-salt. He was not aware the range of the mercury thermometer had been extended in the way Mr. Butterfield mentioned.

TREATMENT OF GAS-WORKS WASTE.

According to "Progressive Age" (New York), there has recently been published a report on the "Disposal and Purification of Factory Wastes or Manufacturing Sewage," by H. W. Clark, the Chemist of the Massachusetts State Board of Health, in which were the following references to gas-works wastes and the experimental work done upon them.

Experiments were made upon the purification of the wastes resulting from the manufacture of both coal and water gas. Taken as a whole, the waste liquor was a very turbid, brownish-black fluid, containing considerable floating oily matter saturated with carbonaceous matters in solution (hydrocarbons), and having a heavy sediment of tar. It was soon evident that chemical treatment would be necessary before filtration. Many experiments with both lime and copperas as precipitants were made on the entire mixed liquor, and also on the separate wastes from the water-gas plant and the coal-gas plant. Chemical treatment was successful in coagulating and removing by sedimentation a large percentage of the suspended and dissolved matters in these wastes. Lime at the rate of 1½ tons per million gallons was effective generally with the wastes from the water-gas plant; but with the wastes from the coal-gas plant more certain results were obtained when copperas was used in combination with lime, in amounts averaging about a ton to each million gallons of liquor treated. The solid matters in the untreated liquor varied at times from 3000 parts to 52,000 parts per 100,000—a large percentage of which was loss on ignition. The total solid matters after chemical treatment were generally less than 100 parts, with from 20 parts to 40 parts loss on ignition.

The volumes of wastes from the process of making water gas varied from 5000 to 25,000 gallons per day, while the volume of wastes from the coal-gas plant was much less in amount.

A filter containing a mixture of sand and coke was operated at this plant for several months—taking all the supernatant liquor after treating the entire water-gas wastes with lime, sedimentation, and coke straining. The time required for chemical precipitation and sedimentation was generally but little over an hour. The coke strainers were only a few feet square, placed in walls, dividing the sections of the settling tank. The filter was operated at rates from 500,000 to 2,000,000 gallons per acre daily; and although the latter rate was too great to allow much change in the liquor, still many of the odours were removed while it passed through the filter. The resultant liquor was, generally, fairly clear, with little odour and with total solids and loss upon ignition low.

The experiments indicated that there should be but little difficulty in purifying these gas wastes sufficiently by chemical precipitation and rapid filtration or straining. Filtration after chemical treatment, at rates up to 700,000 or 800,000 gallons per acre daily, should produce a clear liquor with little odour and but a small percentage of the original polluting matters. Aëration of this liquor before filtration aids materially the removal of odours.

Volatile Constituents of Coal.—In the "Journal" for the 3rd of January (p. 25), we noticed the investigation now being carried out by Messrs. Burgess and Wheeler into the subject of the volatile constituents of coal. In continuation of their previous work, the authors have studied the action of heat on coal—paying particular attention to the composition of the gases evolved during successive stages of distillation at a uniform temperature; and the results have recently been submitted to the Chemical Society. They find that coal contains two types of compounds of different degrees of ease of decomposition. One (the more unstable) yields the paraffin hydrocarbons and no hydrogen; the other, decomposed with greater difficulty, yields hydrogen alone (or possibly hydrogen and the oxides of carbon) as its gaseous decomposition product. The authors consider that the difference between one coal and another is determined mainly by the proportions in which these two types of compounds exist; and that the true "coal substance," apart from the traces of sulphur compounds and other substances which mask its character, is compounded of the two types that behave so differently under the action of heat. It has been shown that there is considerable justification in assuming that one type of compound in coal, the vegetable origin of which is undoubted, is a degradation product of cellulose. The authors identify the "hydrogen-yielding constituents" with this type, and regard the "paraffin-yielding constituents" as being most probably derived from the resins and gums originally contained in the sap of the coal plants. They suggest that the substance which Mr. Bedson has shown to be extracted in considerable quantity from coal by the solvent action of pyridine is compounded of the "paraffin-yielding constituents;" and they therefore regard coal as a conglomerate of which the degradation products of cellulose form the base, and the changed resins and gums of the coal plants the cement.

PETROL AIR GAS.

By E. Scott-Snell.

[Extracts from a Paper read before the Society of Engineers.]

The idea of supplying carburetted air for lighting purposes is nearly a century old, but was of no value from a practical point of view until the introduction of the incandescent mantle made it possible to use a gas which was comparatively weak in hydrocarbon and had no particular lighting value *per se*. The failure of the old machines was due to the exceedingly high cost of the light when obtained from a luminous flame (necessitating, as it does, the use of a gas very rich in hydrocarbon), and also to the fact that a gas so rich in vapour could not hold its vapour at temperatures as low as those often met with in practice, with the result that the petrol was deposited in the pipes and lost substantially in illuminating power. The introduction of the incandescent mantle, however, allowed the use of a gas which had no pretensions to illuminating power, but was a gas whose sole function was to supply the highest possible temperature at the point of combustion. In fact, a gas so low in petrol vapour as 1½ per cent. can be used; whereas the old flat-flame system demanded a gas containing about 12 per cent., to be of any use. The best proportions of vapour to air the author considers to be between 6 and 10 per cent.

To arrive at any conclusion as to the best mixture to employ, one must consider, side by side with the laws of evaporation and the physical properties of the hydrocarbon used, the conditions the gas must fulfil in actual practice. The main feature of the gas must be its inability to deposit petrol in the system at any temperature it may meet with in the service on its way to the burners; and the next consideration should be the impossibility of combustion of the gas in the system itself—*i.e.*, one should, if possible, deliver a gas which insures that, even if the gauze of a burner perish, or a flame in any way be carried back into the service, explosion of the apparatus would be impossible. The following considerations are essential in examining the proportions which fulfil these conditions.

Petrol consists in the main of the lighter hydrocarbons of the paraffin series having the formula C_nH_{2n+2}. In fact, the petrol used for lighting purposes consists almost exclusively of pentane (C_5H_{12}), hexane (C_6H_{14}), heptane (C_7H_{16}), and traces of octane (C_8H_{18}), in varying proportions according to the specific gravity and source of the fuel. For instance, the "Anglo-Special Spirit for Gas Making," sp. gr. ·680, upon fractional distillation, comes over as follows:—

Probable Composition Judging from Boiling-Points.

1 per cent. at	50° C.	Pentane and hexane.
27 ,, ,,	60° ,,	
28 ,, ,,	70° ,,	Hexane.
19 ,, ,,	80° ,,	Hexane and heptane.
12 ,, ,,	90° ,,	
6 ,, ,,	100° ,,	Heptane.
3·5 ,, ,,	106° ,,	Heptane and octane.

As the highest efficiency is given by a mantle when raised to incandescence by a gas which gives the highest possible temperature at the point of combustion, and this is synonymous with the mixture giving complete combustion, it is easy to find this mixture from theoretical considerations. Taking hexane, which is the most important constituent of petrol used for lighting purposes, the equation of complete combusion is—

$$2\ C_6H_{14} + 19\ O_2 = 12\ CO_2 + 14\ H_2O$$

from which we gather that

2 vols. of vapour require 19 vols. of oxygen contained in (19 × 4·81 =) 91·3 vols. of air

∴ 100 vols. mixture contain $\frac{200}{92{\cdot}3} = 2{\cdot}17$ per cent. of vapour.

Calculations give as the mixtures for complete combustion—

Pentane sp. gr.	·626	. . . .	2·53 per cent. by volume.
Hexane ,, ,,	·663	. . . .	2·17 ,, ,, ,,
Heptane ,, ,,	·688	. . . .	1·86 ,, ,, ,,
Octane ,, ,,	·719	. . . .	1·64 ,, ,, ,,

Anyone acquainted with the theoretical aspect of internal combustion engines knows that the greatest explosive effort is given with substantially this mixture of air and vapour. In practice, slightly more air is used to ensure complete combustion. The undesirability, then, of supplying this gas direct through the pipes is obvious, though it is exactly the mixture required at the mantle. Practically all plants used for making this gas employ a holder to store a certain amount of it, either for direct use or for governing the apparatus relatively to the demand; and if fired by accident, this is likely to "give furiously to think." The author has seen the results of an explosion of this kind which were, to say the least of it, impressive. Experiment shows, however, that the upper limit of combustibility (without the addition of further air) is reached when the amount of petrol vapour in the mixture is 6 per cent. or over (Redwood puts it at 5 per cent., Sorel at 4 per cent.); and it is impossible to fire such a mixture in the pipes and gasholder. In fact, it behaves in exactly the same way as coal gas, and is absolutely safe from the danger of explosion in the system itself.

Evidently, then, to be safe, we must use a mixture of not less than 6 per cent.; and dilute it to the desired proportions for complete combustion at the burner-head by a burner of the bunsen type. We are immediately brought to the question of how much richer than 6 per cent. we may allow the gas to be. This is governed by the necessity of fulfilment of the first of our essential conditions—viz., that the gas must not deposit petrol in the pipes under any conditions of temperature likely to be met with in an installation. If we find what is the richest mixture stable under these conditions, we shall have all our factors satisfied if we strike a balance between this and the upper combustible limit—thus giving a margin either way.

As the gas is usually generated in an outhouse, and may have to traverse a section of piping exposed to the frost, one ought to employ a gas stable at some degrees below freezing point—*i.e.*, a gas which does not become "saturated" until a fairly low temperature is reached. [In dealing with this point, the author set out the laws of evaporation at some length.] The author made some experiments on condensation with a 6 per cent. gas made from Anglo-Special spirit of sp. gr. ·680, and found that at 0° C. there was a faint deposit (a dew-point instrument had to be employed to indicate this), but that the gas could be run through a coil of pipe kept at — 10° C. by a freezing mixture, without a deposit of any appreciable magnitude. In fact, the gas was kept burning in a bunsen burner for some hours with the coil at this temperature. The small quantity that was condensed had quite a different smell from that usually associated with petrol, and was very heavy, having a sp. gr. of about ·760. This latter figure was very difficult to determine, owing to the minute quantity available; and the writer would not vouch for its accuracy. In order to discover the condensing-point with regard only to the petrol, the gas was dried by passing over calcium chloride before entering the freezing mixture.

As the piping in any installation is usually either sunk in the ground or inside the house, a very low temperature will hardly ever be met with in practice, so that trouble from condensation of a 6 per cent. gas need not be expected. One is always more likely to find water in the pipes than petrol; but this depends to a great extent upon the design of the machine, particularly in respect to methods of carburation. The deposition of water in the pipes is not of any great importance, as it can always be removed from syphon-boxes in any properly-designed installation. But the deposition of petrol means loss of heating value from the gas, and may even become a source of danger if it can leak through the joints. The author would like to state here that, in an experience of five years of work in connection with petrol gas, he has never come across petrol in pipes, except in a case where heavy motor-car petrol was used, and carburation was effected at a temperature very much above normal.

The foregoing arguments show that there is no objection to a rich non-explosive mixture, provided it is not too rich. Most makers of petrol-gas apparatus, however, seem to prefer a mixture in which all the air for combustion is sent through the pipes, and none taken in at the burner. This is, of course, a violently explosive mixture in the gasholder, which may be fired if a flame can by any accident flash-back along the pipes. Hence these manufacturers have to take the most stringent precautions against this possibility; and to this end their burners are choked up with fine gauze or similar dust-collecting material, and there are, or should be, sets of gauzes at the exit from the machine into the service. It may be argued that in a machine making a non-explosive gas the possibility of failure of the petrol supply may cause it to become explosive. This is a perfectly fair contention; and it would be well to examine the possibility of trouble should this occur.

It is an essential of efficiency that the gas at the point of ignition should be a self-burning one—*i.e.*, an explosive mixture—and when using a rich non-explosive gas, this effect is obtained locally by means of a bunsen burner—the gas issuing from a small nipple, and drawing in a further supply of air on its way to the burner-head. Obviously, then, if a rich gas in the service produces an explosive mixture at the point of combustion—*i.e.*, about 2 per cent. of vapour to air—an explosive gas in the service will produce a very weak one at the burner-head (in fact, a mixture too weak to burn at all, and so put all possibility of lighting-back out of court). The writer found that, with a machine making a 6 per cent. gas (the same being diluted to the self-burning mixture at the burner-head), upon shutting off the petrol supply, and still allowing the machine to run, the lights soon became dim; and in a short time the flame lifted right away from the mantle and went out. By the time that the failure of the petrol supply had reduced the gas in the service to the explosive point, all danger of firing this was removed by the burners automatically going out. Even if by any mischance—the writer cannot conceive one occurring in practice—the flame could be lighted at the nipple, the latter consisting of a comparatively heavy piece of metal of high thermal capacity, with a small hole in it from which the gas issues, acts in exactly the same way as a piece of gauze, and extinguishes the flame by lowering its temperature.

It will be noticed that most—if not all—of the systems employing the low percentage gas are those in which some hand regulation of the mixture is provided for—*i.e.*, machines in which the gas is apt to vary. The fact of the provision of any mixture regulator is, in the author's opinion, an admission of the fact that the machine cannot be relied upon to keep delivering a gas always of the same "make." Now, if the proportions of the mixture have to be regulated, some index of the desired mixture has to be provided; and as the condition of a self-burning mixture is very strongly marked by the colour of the flame when burned without a mantle, a pilot-jet can be fixed on the machine so as to give the

necessary information. If a richer gas were made for the service, this index would be of little or no use, as a gas rich in hydrocarbon burns with a yellow flame of very little variation of intensity over a fairly large range. Hence it is very convenient to burn a 2 per cent. mixture in a machine which cannot be relied upon to keep the same gas automatically.

A point which is little understood by the layman is the relative values, from the pecuniary point of view, of a gas which contains only 2 per cent. of vapour in its composition, and a richer one containing (say) 6 per cent. He is apt to imagine he is getting more value for his money when his machine delivers 1000 odd feet of gas to the gallon of petrol (since "air costs nothing"), than if it only delivered 500 cubic feet. When petrol gas first came into prominence, a great deal was made in advertisements of the low cost per 1000 cubic feet compared with coal gas; so an examination of the claim might not be out of place here.

The author gathers that each cubic foot of vapour produced from "Anglo-Special Spirit, ·680" requires for complete combustion 45·5 cubic feet of air; and a gallon gives 28·4 cubic feet of vapour. From this, it will be seen that one can obtain 1318 cubic feet of gas to the gallon of spirit, and all for the comparatively small sum of 10d. Coal gas being sold in the country at an average price of about 3s. 6d. per 1000 cubic feet, it is no wonder gas managers began to wriggle when petrol gas first came on the scene. But the excessive cheapness was more apparent than real. The calorific value of this particular petrol is 19,500 to 20,000 B.Th.U. per pound, or, taking the lower figure, 132,000 B.Th.U. per gallon. Hence the calorific value of this gas is only just over 100 B.Th.U. per cubic foot, and gives a lighting value, when burnt, of little over 5 candles per foot. Coal gas has an average value of about 600 B.Th.U. per cubic foot, and gives a lighting value of 20 candles per cubic foot when burnt at low pressure with a mantle. Again, oil gas can be produced in the Mansfield apparatus at about 5s. per 1000 cubic feet—an apparently high figure, until one is acquainted with the fact that it has a calorific value of 1200 B.Th.U., and gives an efficiency of 40 to 50 candles per cubic foot. From the foregoing, it is obvious that the figure simply of "so much a thousand" is utterly useless as an index of the cost of any gas.

The only valuable advantage in making a very weak gas is that an escape is immediately diluted down beyond the combustible limit by the air it meets in the room. But there is no excuse for having any escapes, especially as—the specific gravity of the gas being over 1—little over half as much petrol gas as coal gas will escape through a given leak. No insurance company considers a coal-gas installation a menace from the insurance point of view; so that, in the author's opinion, there is very little value in this point, and certainly it is of no value as a set-off against a dangerous gas in the gasholder.

In the category of machines which rely upon hand regulation to keep the gas right, the writer would include all machines using a "surface carburettor" in any shape or form, or machines in which the fuel is allowed to run into the carburettor by gravity through a hole the proportions of which are governed by a needle which more or less chokes the aperture.

As there are on the market several machines of the surface carburettor type, it might be as well perhaps to define the term. By a surface carburettor, the author means one in which excess petrol is supplied by any float-feed or similar device, and air is allowed to pass over it, picking up as much hydrocarbon as it can hold in the form of vapour. Sometimes this is passed straight on into the service, and forms a very rich mixture which is burned at bunsen burners, or else is diluted down to the self-burning mixture by a hand-regulated device (with which is usually arranged some attempt at an automatic control). Neither of these systems is, in the writer's opinion, satisfactory, as the amount of vapour which air will hold is governed by so many variable factors (time of contact, temperature, humidity, and, worst of all, selective evaporation—a factor which it is practically impossible to control). In the case of the petrol feed through a hole choked by a needle, the alterations of viscosity of the fuel have to be reckoned with; and where the needle is controlled by the height of a relief-valve—when lights are reduced in number the gasholder raises the air exhaust-valve and closes down the petrol supply by the needle—an adjustment is only reliable for a given speed of the engine.

There is another class of machine which uses a weak mixture because by so doing the latent heat of evaporation can be obtained from the air absorbing the vapour, and hence no heat has to be supplied from an outside source. If no heat is supplied other than that derived from the specific heat of the air and the liquid, a drop in temperature of about 28° C. will result; and, unless the air is supplied at several degrees above zero, the temperature will drop below the saturation temperature of a self-burning mixture, and the air will not hold even the 2 per cent. of vapour necessary for such a mixture. A machine built upon these lines, therefore, must be doubtful in frosty weather; and anyhow the air has to pass through some drying agent in order to take out all moisture before it reaches the carburettor, or the latter will soon choke up with snow and ice.

One of the first essential considerations in the design of a petrol-gas plant is that of the motive power to be used to drive the apparatus. In order that the drop in pressure due to the passage of the gas through the pipes may be, for practical purposes, negligible compared to the pressure at which the gas enters the mains (and that the pressure at each point should be sufficient in the case of any rich gas to enable it to inject the extra air necessary for complete combustion, or in the case of a mixture already of self-burning proportions to force it through the layers of gauze, &c., used to prevent flashing-back), it is found in practice necessary to deliver the gas from the machine at between 1 inch and 2 inches of water-column. Now, a 40-candle power unit may require a consumption in the case of a 6 per cent. gas of as much as 4 cubic feet an hour, or in the case of a self-burning mixture of 11 cubic feet an hour. The author is aware that these figures may be criticized by makers of petrol-gas plant; so he would state at the outset that they are based upon experiments in a laboratory with machines of both types under ordinary running conditions. Now, a pressure of 1 inch of water-column is equivalent to 5·2 lbs. per square foot. Hence, the energy required for a 40-candle power unit consuming 4 cubic feet an hour at 1½ inches is $1{\cdot}5 \times 5{\cdot}2 \times 4 = 31{\cdot}2$ foot-pounds, and with a weak gas consuming 11 cubic feet an hour $1{\cdot}5 \times 5{\cdot}2 \times 11 = 85{\cdot}8$ foot-pounds, which reveals another advantage of the richer gas. Taking as a typical example a house in which there may be 50 lights all on at once, it will be seen that in one case an expenditure of 1560 foot-pounds is required, and in the other 4290 foot-pounds for every hour's run. Hence, petrol-gas machines seldom require to be driven by anything more powerful than a hot-air motor or wound-up weights. In the author's opinion, the latter method is the more satisfactory of the two; for in a well-designed weight-driven apparatus, the power expended is always proportional to the load from all lights on down to a small bye-pass, and should all lights be turned out no power is wasted—the power coming into operation again immediately a light is turned on. But in the case of an engine-driven plant, it is necessary to run the engine continuously, whatever the load; and should it be thought necessary to provide for an emergency during the night (when in the ordinary way no light would be required), either the engine must be kept running with no load or a gasholder must be introduced supplementary to the rest of the plant. With a consumption of 11 cubic feet per light per hour, it will be seen that the storage of any useful amount is out of the question.

The foregoing figures of the power required are purely theoretical; and as it is practically impossible to obtain an efficiency of more than 50 per cent., they should be at least doubled to obtain working figures. The writer unfortunately has no figures as to the efficiency of an engine-driven plant, but has found that in one particular case the cost of running the engine of a 25-light plant the whole night on no load came to about 3d.

As one is continually being asked for comparisons with coal gas, the following information should be of value. It may be stated at once that such comparisons are never satisfactory to both parties concerned, as there is the inevitable difference of opinion as to what is the average efficiency which may fairly be assumed in each case. The difficulties of such comparisons will be obvious when it is pointed out that, according to how coal gas is burned, the duty obtainable from an incandescent mantle may vary from as low as 11 candles per foot to as high as 40 candles per foot or more, though the latter is only possible with special compressing apparatus. The writer was present at some photometric tests made by Messrs. Mansfield and Co. (the well-known oil-gas firm) with two different types of petrol-gas apparatus. They were tested just as sent out by the makers, and as presumably they would be installed in a private house—that is to say, no special attempt was made to tune them up for the occasion. The tests may consequently be considered as being made under quite average conditions. With rich petrol gas of 334 B.Th.U. per cubic foot gross, a duty of 11·6 candles per foot was obtained (or, to be exact, a 35-candle power unit consumed 3 cubic feet an hour). Now, with petrol of ·680 sp. gr. and calorific value of 19,500 B.Th.U. per pound, we get a value of 132,600 B.Th.U. for 10d. net (which is about the present price of spirit after rebate of the tax to the consumer), from which data it is easily calculated that we get 1000 candle-power-hours for 2·17d. Assuming an efficiency for coal gas of 20 candles per cubic foot (and the writer considers this a very fair average for low-pressure house lighting), with gas at 3s. per 1000 cubic feet (again a fair figure) we get 1000 candle-power-hours for 1·8d. Hence, light for light, petrol gas in this particular case was equivalent to coal gas at $\frac{2{\cdot}17}{1{\cdot}8} \times 3\text{s.} = 3\text{s. } 7\frac{1}{2}\text{d.}$ per 1000 cubic feet. It is interesting to note, in support of the contention that these are fair comparisons, that Professor Vivian B. Lewes, in the tenth edition of the "Encyclopædia Britannica" (Vol. 31, p. 653), gives the price of 1000 candle-hours, with coal gas at 3s., as 2¼d., and with petrol at 10d. per gallon, as 2d.

Any attempt at competition with coal gas is very much handicapped in the case of petrol gas by the consideration of the initial cost of the plant. In view of the very large field outside the radius of any central coal gas or electric lighting scheme, one would not expect makers of petrol-gas plant to spend time and money on any such competition. Their chief rivals are acetylene firms and makers of private electric lighting plants. It is interesting to note that, from figures given in a pamphlet issued by one of the best-known acetylene firms, the price per 1000 candle-power-hours from acetylene works out at 6·25d., or, light for light, three times the cost of petrol gas. The author has no reliable figures for the cost of light generated by a self-contained electric set; but the initial cost of a sound apparatus is very heavy compared with that of a petrol-gas plant, while there is the disadvantage of not being able to use it for the ordinary domestic purposes of cooking and heating, except at a ruinous figure.

This paper refers exclusively to the principles of petrol air-gas lighting; and no detailed examination has been made of the

different methods of its generation. It should be realized, however, that the design and construction of a machine are factors quite as important as is the fulfilment of the considerations here dealt with. The difficulties in the path of the designer will be realized when it is pointed out that, in an ideal plant, gas of unvarying calorific value and unvarying pressure has to be produced automatically to meet a demand varying from full-load down to a mere bye-pass under conditions of temperature varying within quite wide limits; and that this has to be effected with a fuel which, in its physical relationship to air, is peculiarly sensitive to these same ever-changing factors of velocity and temperature. Mor eover, it must be remembered that the apparatus must be such that it can be left in the hands of any unskilled person—such as a domestic servant or a gardener—and must therefore be "fool-proof," and never need attention other than that involved in ordinary routine work. Worst of all, gas can be obtained by anyone by blowing air across petroleum spirit on its way to a burner, with the consequence that all manner of unscientific persons are tempted into the field, the only result of whose labours is the loss of money and the "queering of the pitch" for firms running machines of sound construction and design which are necessarily the result of prolonged study and investigation. Is it any wonder, then, that the history of petrol air gas is strewn with the corpses of unsuccessful undertakings?

After reading the paper, the author showed an inverted burner consuming air gas containing about 6 per cent. of petrol vapour; and he also made a few experiments. One of these was to demonstrate that the 6 per cent. mixture was non-explosive when lighted at a large opening without the intervention of any gauze between the gasholder and the flame. Another experiment aimed at showing that a lower grade mixture was explosive.

Discussion.

Professor C. A. Smith, of the East London Technical College, said that some time ago he issued invitations to makers of air-gas plant to send apparatus to an exhibition at the college in connection with a lecture which he was giving. Three firms forwarded plants; and there was a remarkable difference in the manner in which they were installed and worked by the three firms. One firm installed their apparatus quickly, and in a proper engineering manner; while another took several days to fit up the apparatus, and even then seemed unable to trust it to work without continual watching.

Dr. S. Rideal referred to the difficulty of maintaining constant proportions between the volume of petrol vapour and of air, owing to the effect of changes of temperature and pressure on the working of the carburettor. He had recently returned from a journey to the East, and had noticed that petrol-air gas plants were being installed in large numbers in India and Burmah. This growth in the use of air gas was no doubt due to the increase in the facilities for obtaining petrol all over the world; but he was doubtful if many of the types of carburettor supplied with air-gas plants would work satisfactorily at the high temperatures which commonly prevailed in the East.

Mr. W. J. A. Butterfield said that there was much to comment upon and to criticize in so comprehensive a paper. In regard to the principles governing the employment of petrol vapour for carburetting air, the author appeared to have overlooked the investigations made 15 to 25 years ago by Professor Bunte, Professor William Foster, and many English gas engineers, on the vapour tension of carburine and petroleum spirit in connection with the problem of the carburetting or enriching of coal gas. This information was crystallized in the text-books on gas manufacture; and it would have been interesting if the author had put it alongside the later data which he had quoted. The author advocated the use of comparatively rich air gas, and considered that any poor mixture which was combustible was necessarily also explosive. The speaker, however, had many times, when inspecting air-gas plants making the poorer grade of gas, asked the makers if they guaranteed that it was non-explosive; and on receiving their assurance that this was so, he had had a burner removed and a flame applied to the open end of a pipe. No explosion ensued, and the gas would not even light. Nevertheless, it was at the same time giving a good light when consumed in the properly-constructed burners used. The author also, in speaking of the 6 per cent. mixture as non-explosive, and therefore less dangerous than the lower-grade mixtures, had not referred to the fact that an escape of 6 per cent. mixture into the air of a room very quickly produced an explosive atmosphere. It was not, as he implied, comparable in this respect with coal gas, because a very much greater admixture of air was necessary to render coal gas explosive. As to the heating value of petrol gas, the speaker had a little time ago had to investigate the question of the relative advantages of petrol air gas and town gas for industrial heating purposes. He had tried town gas and air gas of various grades in suitable burners for heating purposes, and had found that when (say) 60 per cent. of the heat was utilized in the case of coal gas in any operation, 60 per cent. of the heat of the air gas was similarly utilized in the same operation. Hence, for practical purposes the relative heating values depended simply on the relative calorific power of the coal gas and of the petrol used in producing the air gas. As a result, he had come to the conclusion that coal gas of 600 B.Th.U. per cubic foot, if costing 2s. 6d. per 1000 cubic feet, was equivalent for heating purposes to air gas when petrol cost 7½d. per gallon. This referred only to the cost of the petrol, and not to the expenses involved in converting it into air gas. In regard to the comparative figures quoted by the author for the relative cost of lighting by air gas and acetylene, he would remark that the acetylene figure evidently referred to open-flame burners, and that if upright incandescent burners were used for acetylene the cost of lighting by means of this gas was at once halved. The inverted burner, which had recently been made available for the consumption of acetylene, introduced further economy. There was no reason why, if mantles were not objected to for air gas, they should be objected to for acetylene lighting; while acetylene had the further advantage that it could be used in open-flame burners, whereas the day for air gas of a grade suitable for open-flame lighting was long passed.

Mr. A. Valon referred to some comments made by Professor C. A. Smith on the variation in the calorific power of the gas in different districts of London, and on its effect on the illuminating power of gas-lamps. He (Mr. Valon) pointed out that even now there was a standard of calorific power of gas fixed in London, and that supposing the calorific power of gas were uniform all over the country, there would still be differences in the illuminating duty obtainable from lamps owing to the variations in the composition of the gas and the proportion of air required for its combustion. The differences noted by Professor Smith were, no doubt, due as much to differences in the composition of the gas as to differences in calorific power. As to the use of air gas, he did not think that it came into competition with coal gas anywhere where the latter was available; and he thought the comparative figures quoted by the author related, on the one hand, simply to the cost of petrol for producing air gas, while the cost given for coal gas was for the gas as delivered to the consumer. No account had been taken of the charges incurred in the conversion of the petrol into air gas, and of the trouble involved in this operation.

Mr. C. Hoddle said that, according to his experience, air-gas plants were not so satisfactory in practice as the statements put forward by their makers promised. He knew of one case in Ireland recently in which, after three different types of air-gas plants had been tried in succession, the last one had been taken out in favour of an acetylene apparatus. The comparisons made by the author of the cost of air gas and acetylene lighting were also, he thought, unfair to the latter.

Several other speakers joined in the discussion, one of whom called attention to the "quality" of the air-gas light, which, he said, was generally considered superior to that of any other illuminant—a view from which some of the audience dissented.

The President (Mr. F. G. Bloyd) then called upon the author to reply.

Mr. Scott-Snell, referring to Mr. Butterfield's remarks as to the non-explosiveness of the poorer grades of air gas, said that the gas, if combustible, must be explosive; and the fact that it did not explode when issuing from a tap from which the burner had been removed, was simply due to the pressure at which it issued. He did not believe the statements made by the promoters of the low-grade air-gas systems that the gas was not combustible in the ordinary sense, and that combustion was simply due to the so-called atomizing effect of the special burners. He could quite understand that some difficulty might arise in the use of air-gas plants in extremely hot countries, unless the carburetting arrangements were of a proper description. In such cases, surface carburetting was bound to prove unsatisfactory. As to the relative explosiveness of mixtures of air gas and coal gas mentioned by Mr. Butterfield, he believed that the range of explosibility was very much wider in the case of coal gas than in that of petrol vapour; but he would look up the exact figures, and see that they were included in the published report of the proceedings of the meeting.

A Condensing Gas-Stove.

It may be remembered that in the letter by Dr. Percy Wilde reproduced on Feb. 14 (p. 790) from the Engineering Supplement to "The Times," he referred to a condensing gas-stove which he has in use. The following particulars in regard to it were published in "The Times" last Wednesday: "In this stove the fumes from the burnt gas rise into a flat oblong tank about 3 feet long, which forms the top of the stove. Thence they are conducted by four tubes, also about 3 feet long, down to a similar tank, which constitutes the base. This tank contains water and slaked lime; and the fumes, cooled by their circulation through the apparatus and by contact with the water, pass round to meet the hot fumes in the flue behind the burners. The result is rapid condensation, with production of a vacuum which causes the draught necessary to draw air into the fire. The water of condensation absorbs the carbonic acid, and, trickling down into the bottom tank, combines with the lime, forming carbonate of lime, which being insoluble is precipitated. As the slaked lime is used up, the carbonic acid combines with the carbonate of lime to form bicarbonate, which is soluble; and the solution, when its amount becomes excessive through the constant additions of condensed water, is drawn off by a small tap. It is stated that 8 lbs. of slaked lime will last five or six months before being dissolved with a fire consuming 8 or 10 cubic feet of gas an hour, and burning (say) 12 hours a day. Radiant heat is emitted from the burners, which are of the bunsen type heating asbestos strings, through a talc front; while the metal surfaces of the top tank and the pipes that lead to the bottom tank, the temperatures of which it is said do not exceed 100° C., gently warm the air of the room by convection."

REGISTER OF PATENTS.

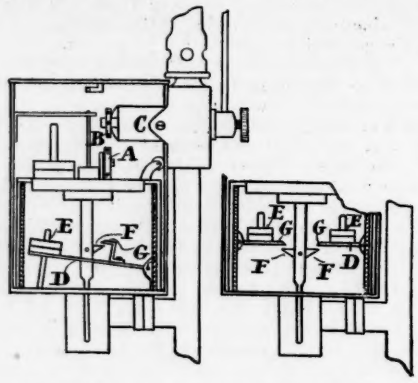
Pressure-Controllers for Gas-Lighting Systems.

SPARKS, E., of Tufnell Park, N.

No. 7033; March 21, 1910.

This invention relates to devices for controlling gas-lighting systems by variation of the pressure in the mains—of the type described in patent No. 22,805 of 1909.

According to the present invention, the piston, which in rising operates a step-by-step valve, is provided with a restraining device comprising a lever adjustably weighted and so arranged that when the piston has exceeded the limit of play provided its further rise will cause a pawl on the stem of the piston to lift the weighted lever until the latter rides off the ascending pawl, and this pawl thereafter yields as the piston subsequently descends to its lowermost position.



Sparks' Pressure-Controller for Gas-Lamps.

As shown, the piston or bell, which carries the pawl A operating the ratchet-wheel B on the gas-cock C so as to rotate the ratchet one tooth each time the piston rises, is provided with a stem which carries a pivoted pawl or pawls F, projecting transversely from it. The pawls will not yield as the stem travels upward, but yield as the stem and piston descend. The pawls are adapted to engage a projection from one or more weighted levers G pivoted above or below the piston.

One form of weighted lever consists of an annulus D provided with an external lug, whereby it may be mounted approximately horizontally in a bearing or on a tangential pivot between uprights. This annulus may carry upstanding studs on which weights E are mounted; but a modification of this annulus may be employed, as shown.

The pawls F are mounted upon the stem in such position that the piston can rise some little way before they meet the projections G upon the annulus or weighted levers. When the full pressure is exerted under the piston, the latter rises until the pawls meet the projecting ends of the weighted levers; and the pressure being maintained, the latter are raised and then finally left clear of the engaging pawls so as to resume their normal position—leaving the piston free to ascend and operate the gas-cock as described in the 1909 patent.

The weighted levers having now resumed their normal position, the piston is freed from their weight, and will not descend until the actual minimum pressure arranged for is reached, when it will descend—the pawls now riding idly over the projections of the levers. Any intermediate fluctuation taking place between the rise and fall of the piston will not affect the operation of the gas-cock.

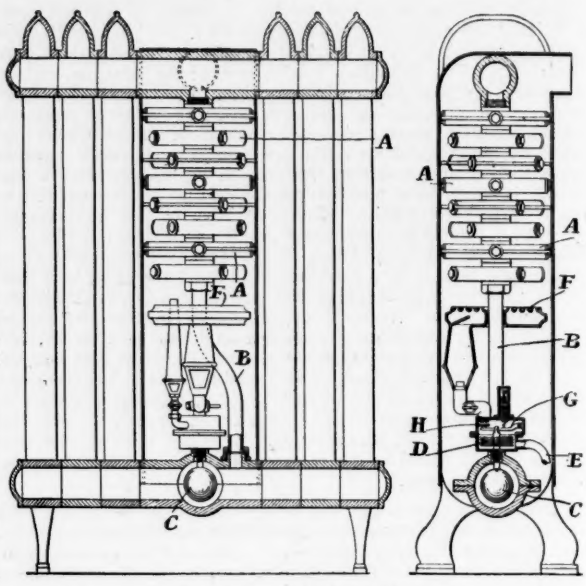
Gas-Heated Radiators.

GLOVER, T., of Edmonton.

No. 8526; April 8, 1910.

The patentee describes a radiator heated by gas, consisting of the combination of a boiler or water heater positioned at or near the upper part of the radiator and having a casing surrounding it and a flue-way from the casing; the boiler or water-heater being connected with the top and bottom of the radiator. The gas-burners for heating the boiler are controlled by a thermostat operable by air expansion, so as to regulate the temperature of the water in the radiator.

Inside the casing shown is a water-heater, composed of a number of segments A constructed in accordance with patent No. 5826 of 1910 [see "JOURNAL" for March 28, p. 929], and through which the water passes. The segments are connected at the top with the upper part of the radiator, and at the bottom by a pipe B to the lower part, and in the lower part of the radiator, in which is a hollow metallic ball C, leading by a pipe to a thermostat D in a chamber having an inlet connection with the gas-supply pipe E, and an outlet to the gas-burner F, which is under the segments A. Inside this gas-chamber is hinged a lever G, carrying a valve H, which can either control the outlet or the inlet orifices. It is in proximity to, or is connected with, a plug on one disc of the thermostat; a spring (controlled by a screw rod) acting upon the rod to keep the valve off its seating. The tension of the spring is determined to suit the required strength of air expansion in the ball C and thermostat, in accordance with the required operation of the valve H, to ensure the desired heat of the water—that is to say, the spring can be tensioned to allow of the valve being closed, or the opening sufficiently reduced, at any predetermined degree of temperature of the water in the heater.



Glover's Gas-Heated Radiator.

The radiator and water-heater are filled with water to a determined extent and the burner lighted. As the water in the heater gets hot, it rises in the heater and causes a circulation; the colder water from the bottom of the radiator passing outside the hollow metallic ball and into the heater. The gas-valve H is first fully open; but as the water gets hotter, the water passing the metallic ball C is hotter also, and the heat acting on it will cause the air in it to expand, and, operating the thermostatic discs D, will move the lever G and valve H to control the supply of gas to the burners F and lower the gas-flames. Thus an equable heat will be automatically maintained in the radiator.

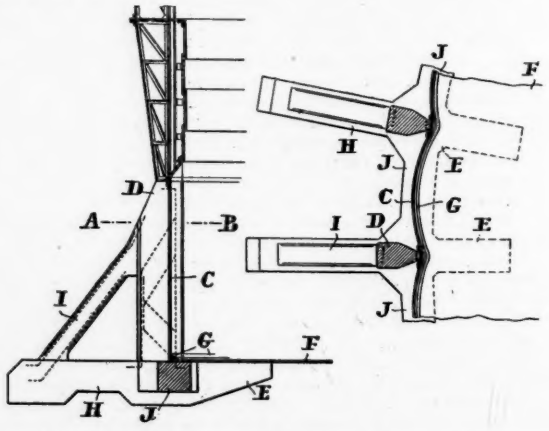
Gasholder Tanks.

BERLIN ANHALTISCHE MASCHINENBAU-ACTIEN-GESELLSCHAFT.

No. 21,470; Sept. 15, 1910. Date claimed under International Convention, June 8, 1910.

This invention relates to tanks of large diameter, and is a modification of the arrangement described in patent No. 10,071 of 1909 [see "JOURNAL" for Sept. 7, 1909, p. 642] wherein the lower portion of the wall and an annular portion of the base of a sheet-metal tank were shown supported by a ferro-concrete ring having vertical and horizontal reinforcing arms. The object of the present invention is to provide such a tank with bowed plates which are supported in a manner similar to that described in the prior patent—"thus rendering the construction of the tank more simple and economical."

The ferro-concrete ring which reinforces the lower portion of the tank has its vertical arms formed as individual members, and spaced to support the edges of the bowed plates; the horizontal arms being extended beyond the point at which the vertical arms join them, and being formed into, or provided with, struts or buttresses, which transmit the radial forces acting on the upper portion of the vertical arms to the horizontal arms and to the foundations of the tank, so that no tension rings are required to take up these radial strains. In this way, the reinforcing ring comprises a series of angle brackets connected together by the ring supporting the annular portion of the base of the tank.



A "Bamag" Reinforced Ferro-Concrete Gasholder Tank.

A construction is shown by way of example in a vertical longitudinal section through the lower edge of the tank and a section on the line A B.

While the upper portion illustrated is preferably made of cylindrical

plates (on account of the smaller pressure of liquid), the lower walls of the tank are formed from bowed plates C, secured between the vertical arms D of the radially extending angle brackets or supports E. The connection between the bottom of the side wall, formed by the bowed plates and the sheet-metal base F of the tank is effected, for instance, by a flanged or an angle ring connection G.

The spaced, radial angle brackets E are preferably made from reinforced concrete and, with the vertical members D, form a crown or rim of angle brackets, the horizontal arms of which take up the strain on the vertical members owing to the pressure of the liquid in the tanks which rest on them, as described in the 1909 patent.

According to the present invention, the horizontal arms of the angle brackets are extended outwards; the extensions H being formed into, or provided with, struts I, which take up the radial forces acting on the upper portion of the vertical arms D of the angle brackets, and transmit them to the horizontal portion or to the foundations. Any arrangement of tension ring to take up the radial strains is thus unnecessary.

The individual angle brackets E are connected together by an annular member J let into the foundations, so that they form one whole.

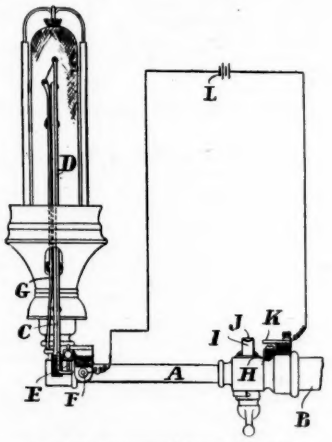
The struts I as well as the angle brackets are preferably made of reinforced concrete, and their shape and construction will, of course, be varied to suit particular requirements.

Gas-Igniters.

GERALD, E. E., of Baltimore, U.S.A.

No. 21,728; Sept. 19, 1910.

According to this invention, a thermostatic rod is employed, which is itself an electrical conductor included in the circuit through the gas-lighting resistance wire. When the rod is cool, one end of it rests against a contact-pin; but when the rod is heated and expands, it is moved away from this pin, and so opens the circuit through the resistance wire. A is an ordinary gas fixture, connected to a supply pipe B. Mounted on the burner elbow, and insulated from it, is a metallic upright C, depending from the upper end of which is a thermostatic rod D, made of metal having a greater coefficient of expansion by heat than the metal of the upright. At the lower end it is bent at right angles, so as to normally rest against a contact pin E, carried by a holder secured on the bracket, but insulated from it. The holder is provided with an extension into which is secured a binding post F.



Gerald's Thermostatic Gas-Igniter.

Secured to the bracket is another metallic upright G, extended parallel to the thermostatic rod a distance short of its length, with the upright C interposed between; the uprights and rod being slidably secured together by bands. Connecting the upper ends of the rod D and the upright G is a platinum wire, which will offer resistance to the passage of an electric current, and thus become heated to incandescence.

Secured on the upper end of the burner-tap is a metallic washer plate H, provided with a vertical extension I, and a transverse extension forming a contact-point J. Secured on the fixture A, adjacent to the tap but insulated from it, is a contact-plate K. L is a battery or other source of electricity.

It being desired to light the gas, the cock is turned away from the position shown so as to permit gas to flow to the burner, whereby the contact-point J is brought into contact with the plate K, which completes the circuit from the battery; so that the platinum wire connecting the upper ends of D and G is heated to incandescence, so as to ignite the gas at the burner.

After the gas has burned a short time, the thermostatic rod D will expand longitudinally, thereby moving the extension on it away from the contact-pin E, thus breaking the circuit—the extension remaining lowered and away from the contact-pin as long as the gas burns, so as to keep the thermostatic rod heated. Should the flame be accidentally extinguished, the rod will cool off and raise the extension again into contact with the pin E, thereby closing the circuit and causing the current to again heat the wire and relight the gas, after which, by heating of the rod D, the circuit will again be broken as before, and remain broken as long as the gas burns.

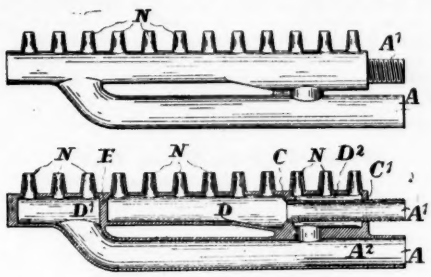
When it is desired to extinguish the flame, the cock is turned to cut off the gas, and turn the contact-point J away from the plate K into the position shown, thereby breaking the electric circuit, which will remain broken until the cock again permits the flow of gas to the burner.

"Duplex" Burner for Gas-Stoves.

WILSON, W. A., of Armley, Leeds.

No. 22,177; Sept. 24, 1910.

The inventor's object is to arrange in one casting a "duplex" burner which may be placed into position in the stove with the supply pipes horizontal, and so that all the flames will be of equal length.



Wilson's Duplex Stove Burner.

As shown, the burner is formed from one casting; the inlet pipes A A¹ being one above the other vertically. To these pipes gas-nipples and [or] bunsen tubes may be attached. The inlet A is part of the casting; while the inlet A¹ is in the form of a tube screwed into threaded apertures C C¹. The casting comprises three distribution chambers, D, D¹, D², the chamber D being stopped at one end by the partition E, and at the other by the aperture C and the tube A¹. The partitions also form walls for the chambers D¹ D²—the exterior of the casting forming the other end walls. From each chamber leads a suitable number of burner nozzles N—thus forming what might be termed groups of inner and outer nozzles.

The chamber D² communicates with the gas-passage A², as also does the chamber D¹. Thus the gas will flow to both chambers and thence to the nozzles. The tube passing through chamber D² prevents any escape of gas or mixture into the chamber D, which may be used along with the chambers D¹ and D², or separately. The flames produced, it is said, will be found to be "of practically even length."

Gas-Engine Governors.

OKEY, P., of Columbus, Ohio, U.S.A.

No. 27,158; Nov. 22, 1910.

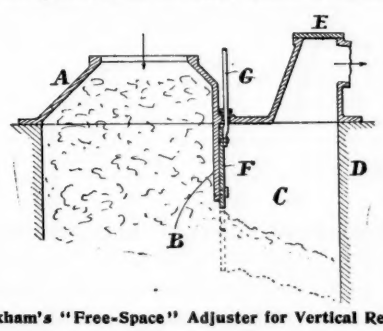
This invention relates more particularly to governors for use upon gas-engines when used for driving dynamos; the primary objects being: (1) To provide a governor which permits a definite amount of gaseous mixture to be delivered to the engine for each working stroke, and that amount to be determined by the work being done by the engine at the particular instant—in other words, to provide a throttling governor as distinguished from the hit-and-miss type, which is not well-adapted for the governing of gas-engines used in driving dynamos. (2) To control the action of the governor by the variations of the voltage in the external circuit of the dynamo; the governor serving to maintain a constant voltage in the circuit, though the load may vary within wide limits.

Vertical Retorts.

DUCKHAM, A. M'D., of Little Bookham, Surrey.

No. 28,388; Dec. 6, 1910.

Vertical retorts for the carbonization of coal have, says the patentee, been constructed in such a manner that the coal charged into them does not at once fill the whole cross sectional area, but is confined for a short distance from the top of the retort by plates depending from the top. Between the wall of the retort and the plates there are empty spaces through which the gases escape from the retort. It is, however, found that such spaces, which are highly heated by radiation from the



Duckham's "Free-Space" Adjuster for Vertical Retorts.

wall of the retort, are of value in breaking-down the liquid hydrocarbons held in suspension in the gases, "whereby useful permanent gases are produced." But it has been difficult to make proper use of the spaces in this direction, because there have been no means of regulating the total amount of heat imparted to the gases as they pass through the spaces.

The present invention is said to overcome this difficulty by making the vertical length of the plates adjustable; "so that the extent of the free

space for the gases may be varied to obtain the best results for a given coal and a given temperature of the retort wall."

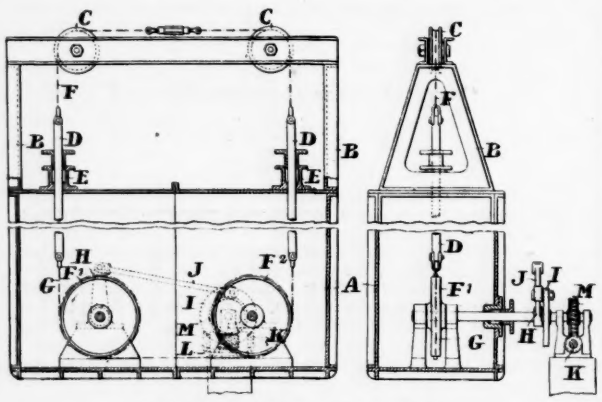
A vertical section is given through the top of a retort to which the invention is applied. The coal is fed through the casting A, one side of which is extended downwards at B so as to form a partition across the width of the retort. By this arrangement there is left a space C between the extension B and the wall D of the retort, and which space is free of coal, and is surmounted by the take-off E for the gases. A plate F is attached to the extension B, so as to slide vertically on it. For instance, the plate may have vertical slots through which extend bolts fixed to the extension. To the plate is fixed a rod G extending through a gland in the cover of the retort; so that by moving it up or down, the plate is raised or lowered to determine the level of the coal outside the extension. The uppermost position of the plate is shown in full lines, and the lowermost in dotted lines.

Washing or Purifying Gas.

C. & W. Walker, Limited, and Bachelor, J. P., of Trench, near Wellington, Salop.

No. 29,925; Dec. 23, 1910.

This invention relates to apparatus wherein two series of plates or scrubbing devices (to be kept in a wetted condition) are mounted in tiers upon vertical rods or spindles in connection with a superposed series of tanks, and adapted to be alternately raised and lowered for the purpose of dipping the plates into the liquid in the tanks and withdrawing them. The means for raising and lowering the scrubbing devices consist in suspending the rods carrying the latter from the two ends of a chain running over wheels or pulleys and connecting the lower ends of the rods to the two ends of another chain, also passing over wheels or pulleys, in such a manner that the rods and chains form part of a closed or endless system; so that when rocking motion is imparted to either of the shafts carrying one of the wheels or pulleys, a corresponding movement, alternately in opposite directions, will be imparted to the chains and also up-and-down movement to the rods carrying the scrubbing devices.



Walker and Bachelor's Washer-Scrubber.

A is the usual washing tank (of any desired height), wherein a series of superposed tanks is arranged, and B is a framing carried on the upper part of the tank and carrying chain-wheels or pulleys C. D D^1 are the vertical rods or spindles to which the scrubbing devices are mounted—sliding through stuffing-boxes and guides E on the top of the tank, and being suspended from the two ends of a chain F which runs over the pulleys C (the chain being advantageously a closed link chain). F^1 F^2 are sprocket wheels, around which the sprocket chain G, which is connected to the lower ends of the rods or spindles D D^1, is passed.

When the sprocket wheel F^1 is moved in the direction of the arrow, the spindle D will be drawn downwards and the spindle D^1 lifted; but when it is moved in the reverse direction, the opposite action will take place—the spindle D^1 will be lowered and the spindle D raised. This oscillatory movement of the wheels is effected by attaching to the shaft of the wheel F^1 a crank arm H, and by connecting to it a rotary crank I, of shorter throw than the crank arm, by means of a rod J, so that the continuous rotary motion of the crank disc I will produce the oscillatory movement of the crank arm H as shown. Rotary motion is imparted to the crank disc I from a shaft K, through the medium of a worm L and worm-wheel M fixed on the spindle of the crank-disc I.

Spirally-Guided and Spirally-Supported Gasholders.

Gadd, W., of Manchester.

No. 8250; April 6, 1910.

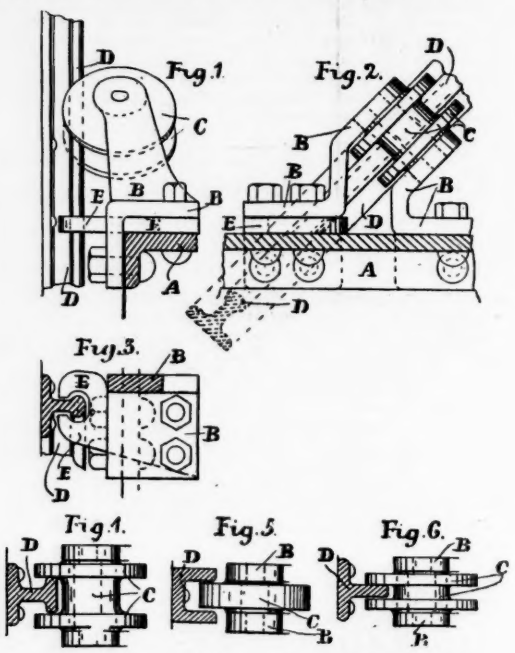
These improvements relate to a further simplification of gasholders constructed in accordance with patents No. 13,521 of 1887 and No. 24,899 of 1905.

Hitherto, for the most part, tangential rollers, in pairs, suited to rail sections of various kinds, have been employed (the patentee points out) for the purpose of gripping the spiral rails or guides whereby such holders are guided or supported; but this detail arrangement does not effectively permit of the simplest forms of spiral rails with the least possible number of rollers or equivalents to be practically relied on.

To effect his present improvements, however, he employs spiral rails of simple section, either single or double angled form, or other simple rail sections; also radial rollers or guiding pieces, grooved or plain, as the rail section may require, which are axially inclined or turned to the angle of the spiral. But they are capable of making side or flange contact with the spiral rail or rails in order to support the holder; and the rollers are thus not only capable of taking up horizontal reaction, but may also take up reactions in other directions.

One such roller, and one simple rail for each point of support, and arranged at suitable distances, may thereby be relied upon to guide and support the holder, "when such economy is desirable."

These rollers are mounted on carriages or carriers fixed to the tank side, or to the top of a lift as the case may be, and are provided with a longer and shorter support for tilting the axes of the rollers to the required angle, or in reverse, on the holder curb, in any suitable manner; "but such carriages are so formed that the bearings can hold the axes of the rollers in double shear, when under lateral pressure."



Gadd's Spirally Guided and Supported Gasholders.

By this application, the web of a simple rail of angle or ⊥ section, or other guide, takes into a grooved axially inclined radial roller, or a simple trough section guide takes into a double grooved or plain radial roller similarly inclined, in such manner that the overturning tendencies at any point, within normal strain, are resisted by the flanges of the grooved roller or side or sides of the plain rollers. Provision for expansion and contraction can also be made by leaving spaces between the rail heads and the faces or bottoms of the grooves or at the plain roller peripheries, as the case may be. By these means, sufficient guidance and support may, when desired, be obtained by one roller to each rail at a point of support, "and yet rail sections of the simplest form and character may be utilized, such as are exceedingly easy to manufacture and attach to the face of the gasholder."

In the case of large holders or holders of considerable relative elasticity, where there is liability to distortion or bending inwards from the rails or guides, particularly on the windward side, spiral guides of a headed type may be employed, and stop bars or plates may be attached to the tank side, or outer lifts as desired. These stops are so formed that they will resist the wind pressure by being shaped to come into contact with the back of the rail or guide-head, whether the rail be cross-head or H section, bulb-head, or is otherwise flanged in section. The stop bars or plates may be either attached to, or form part of, the roller carriers or fixed in other convenient positions.

The carriages or rollers can, when desirable, be affixed in such manner as to be more or less free to turn for purposes of adjustment, or be rendered self-adjusting to the particular angle of the spiral guides—such, for instance, as by allowing a little play for movement of the roller carriers or in the bearing of the roller spindle or shaft. Angled rubbing pieces, under like conditions, may, in some cases, be substituted for the radial angled rollers, so mounted.

Fig. 1 is a sectional view showing a grooved radial roller and a grooved resisting piece mounted upon a portion of the outer lift of a holder, and engaging a bulb-headed rail upon the holder—all according to one form of the invention; and fig. 2 is a view, partly in section, taken at right angles to fig. 1. Fig. 3 is a sectional plan view of fig. 1; while figs. 4, 5, and 6 show radial rollers applied to various rail sections.

A is the upper portion of an outer lift, and B are carriers angled for the purpose of supporting the grooved or plain radial roller C. D are the rails or guides which the rollers engage, and which rails are here supposed to be attached to the outer face of the gasholder. It is, however, obvious that, as in the former invention, the arrangement might be reversed, or the rails be attached to the tank side and the rollers be mounted upon the bottom curb of the holder. It is also obvious that the grooved roller illustrated in fig. 2 might be replaced by a pair of separated discs or flanges. E are stop bars or plates, for the purpose of resisting wind pressure by coming in contact under distortion with the back of the head of the rail, and thus preventing the radial rollers disengaging altogether from the rails or guides D, shown in figs. 1, 2, 3, and 4. Such stop bars or plates may be variously formed for the purpose, and be held in position in any suitable manner. They may

be cut away as indicated by dotted lines in fig. 2 (or otherwise) to conform to the angle of the rail.

For the trough section of rail illustrated in fig. 5, a double grooved roller receives the projecting portions of the rail, or single grooved roller may be used—the flanges being external to the trough, if convenient. In fig. 6, a rail of ⊥ section is shown, the use of which becomes possible when arranged in conjunction with a radial grooved roller or equivalent.

Gas-Retort Charging and Discharging Machines.

MASTERS, R., of Dudley.

No. 7355; March 24, 1910. No. 24,406; Oct. 21, 1910.

This combined invention has reference to machines for charging and discharging through retorts. This type of machine is usually arranged to discharge the coke from one end of the retort simultaneously with the charging in of the coal at the other end. The present invention, however, comprises a machine which has longitudinal bars enclosed in longitudinal casings and adapted to be pushed along the bottom of the retort; each of the bars carrying stout horizontal branch-like "tines," which, on the forward movement of the machine, spread outwardly and push the coal before them into and along the retort, while on the return movement of the appliance, the tines are withdrawn or turned into the casing, so as to be clear of the charge of coal which they leave in the retort. The front end of the casing may carry, as in other discharging and charging machines, a hinged push-plate adapted to push the coke out of the retort and, on the return stroke, to turn up and ride over the top of the charge, or the discharging of the coke may be effected by the first pair of tines.

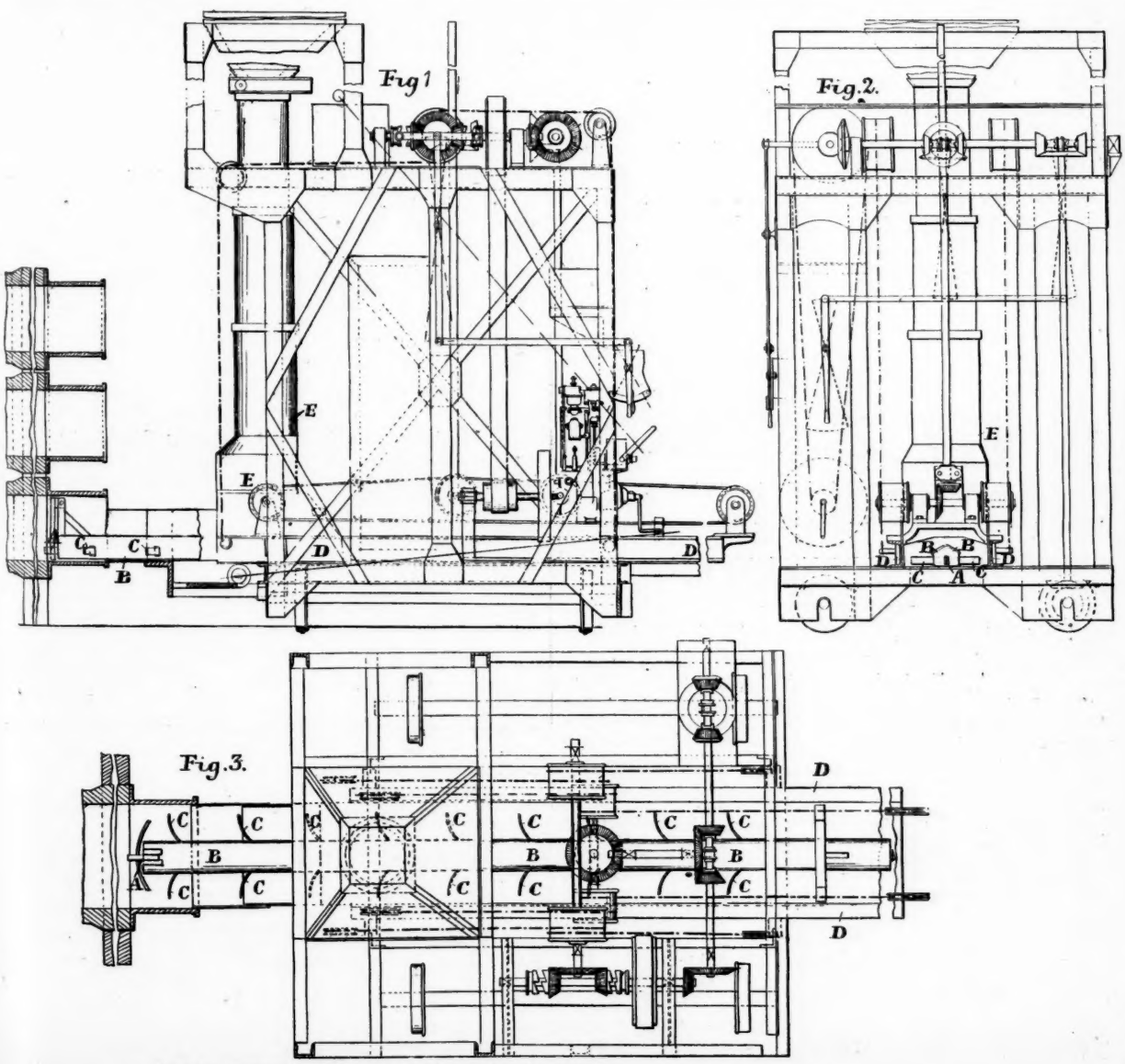
Fig. 1 is a side elevation of the travelling carriage and mechanism for carrying and raising and lowering and adjusting the discharging charger relatively to the retort to be charged. Fig. 2 is a back elevation of the arrangement shown in fig. 1. Fig. 3 is a plan.

A central longitudinal bar A is enclosed in a longitudinal tubular casing B, which is, by preference, made flat at the bottom and with two flat vertical sides and a gable top. The casing is somewhat longer than the retort to be charged—being adapted to pass along the centre of the bottom of the retort. Jointed to cross pieces fixed on the centre bar at intervals there are pairs of stout tines or arms C, which are curved outwardly and project through lateral openings in the casing—being jointed to the ends of the cross projections. The tines are of such a length that when they project outwardly to their farthest extent their ends are well clear of the sides of the retort. The centre bar projects through end plates or bearings in the ends of the tubular casing, and is adapted to slide therein; being operated so that the centre bar can move to and fro for a short distance independently of the casing—being limited by stops. A short forward movement of the bar A, independently of the casing B, moves the tines forward, and they gradually project outwardly more and more until they assume the positions shown in fig. 3 (the position they assume when charging the retort). Then on the bar being moved in the opposite direction, the tines gradually project less and less until they are ultimately withdrawn within the casing (which is the position they occupy when the discharging charger is being withdrawn from the retort).

The casing B is mounted in a horizontal open-topped trough D, the fore part of which is connected with the vertical charging shoot E, down which the coal descends from an overhead hopper, as in other charging machines. The trough, together with the shoot and tubular casing, with its centre bar and tines, are moved up and down and travelled laterally so as to be exactly opposite the particular retort to be charged. The means for carrying the trough and its adjuncts for raising and lowering and moving same longitudinally may be arranged as in other discharging-charging machines, and one suitable arrangement of parts for the purpose is shown. The trough is made about the same length as the tubular casing, so that the latter will lie therein when withdrawn from the retort. The bottom of the trough is preferably furnished with rollers (not shown), on which the casing moves. Suitable means are provided for moving the centre bar, with its tubular casing and the tines, forward into the retort to discharge the coke and carry in the fresh charge of coal, and also for withdrawing the tubular casing and centre bar and arms and leaving the charge of coal in the retort.

In addition to the lateral arms operated by the centre bar as described, there may be upwardly projecting arms similarly arranged and carried by the centre bar, and similarly operated; so that the whole of the arms will then in the forward movement project laterally and upwardly, fan-like, from the casing, and on the backward movement will be withdrawn within it and clear of the coal in the retort.

Moreover, if the retort is a very large one, it may be fitted with two casings and arms and centre bar jointed to it and arranged side by side



Masters' Machine for Charging and Discharging Gas-Retorts.

at a convenient distance apart and operated together as a twin arrangement. In this case, it is preferred for the two centre bars, with their casing, to be one on one side and the other on the other side of the bottom of the retort, with the arms projecting towards the centre of the retort, "as in this arrangement there is no fear of the ends of the arms catching against the sides of the retort on the forward stroke and being bent backwardly thereby."

Utilization of Fine Breeze in Water-Gas Plants.

K. & A. Water-Gas Company, Limited, and Smith, H. E., of Victoria Street, Westminster.

No. 7420; March 24, 1910.

According to this invention (which is limited to water-gas plants which work on the "twin generator" principle, and are constructed in accordance with patent No. 2750 of 1901), after once getting the necessary heats for gas-making, in the usual manner, and with larger fuel, the patentees propose to start feeding regular quantities of small-graded material into either one or both of the generators, immediately the gas-making period commences, and continue to feed throughout this period. In this way, any volatile matter contained in the small-graded fuel so charged is secured in the gas, instead of being wasted through the stack-valves during the blow if the fuel is charged in the ordinary way. By feeding the fine-graded fuel into the generators in this manner, the small quantity so added is said to be readily gasified, and there does not occur any deadening of the fires, as is the case when the fuel is charged in a large quantity, and which necessitates a considerably longer blowing period following the charge.

In order to maintain the fires in proper condition, the feeding of the small fuel may be controlled by apparatus working in conjunction with any of the valve levers for operating the plant, or by mechanism actuated by the variation of pressure in the water-gas plant as between that of the blowing period and that of the gas-making period—such mechanism being constructed (for example) so as to release a gravity feeding valve by means of a diaphragm or other pressure chamber suitably arranged to obtain the power available from the variation of the pressures in the plant. Alternatively, the necessary power to control the feeding may be obtained from the pressure of the steam needed for gas-making on its passage to the water-gas generator; and to utilize part of the energy in the steam for this purpose during its passage to the water-gas generator, a steam-controlled piston or other valve may be employed.

APPLICATIONS FOR LETTERS PATENT.

8256.—Leonard, W., Steane, G. A. & F. L., "Lamps or lanterns." April 3.
8278.—Simpson, J. W., "Closing the passage of a pipe for conveying fluid under pressure immediately the pressure ceases." April 3.
8316.—Forster, A. L., "Gas-fired furnaces." April 3.
8389.—Anderson, D., "Gas lamps and stoves." April 4.
8390.—Hotz, R., "Box for mantles." April 4.
8410.—Major, J., "Jointing of pipes." April 4.
8439.—Howell, R., and Billington, W. J., "Gas-stoves." April 4.
8479.—Keith, J. & G., "Gas cocks or valves." April 5.
8480.—Keith, J. & G., "Burners for furnaces." April 5.
8500.—Sproxton, K., "Cooker plate-rack." April 5.
8513.—Kitson Empire Lighting Company, Ltd., and Noblett, A., "Vapour-burning apparatus." April 5.
8532.—Schwabacher, H., "Lamp-lighters' torches." April 5.
8537.—Glasgow, A. G., "Gas-producers." April 5.
8650.—Clapham, T. S., "Purification of gas." April 7.
8694.—Mueller, O. H., "Cooling towers." April 7.
8700.—Clark, F., and Cutler, G. B., "Gas-making apparatus." April 7.
8725.—Koppers, H., "Convertible gas-retorts and coke-ovens." April 7.
8803.—Pegler, B. C. H., "Cocks and valves." April 8.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Tar-Tanks Lined with Asphalte.

Sir,—In the year 1900, I read a paper on the above subject before the Institution of Gas Engineers, and gave an example of tar-tanks which I had built at Sheffield, with a lining of asphalte as the water-tight medium. Since then I have heard from Mr. J. W. Morrison, the present Engineer of the Sheffield Gas Company, that the lining of this tank, and also of a smaller one constructed similarly about the same time, have failed.

Mr. Morrison attributes the failure to the unsuitability of asphalte for the purpose, due to the material becoming softened with the tar and light oils causing the side walls to collapse. My opinion, however, is that the walls holding the asphalte in place have first failed, and then the asphalte (being a semi-fluid) has sunk, throwing greater weight on the already weakened walls, when the tar would make its way into the cavity which originally contained the asphalte, and so destruction would follow.

Whatever the cause of failure, however, it is well to point out that the design shown in the drawings accompanying the paper I read is not a suitable one, and should not be adopted—at any rate where there is water-pressure outside.

In constructing similar tanks at Coventry, I have adopted the plan of forming arches in the tanks springing from piers in the lining walls, and from brick piers of cruciform section on plan, which takes the place of the cast-iron columns. These arches are continuous, both longitudinally and crosswise of the tanks, forming exceeding strong struts to the lining walls.

One of these tanks, but circular on plan, has been in use at Coventry for eight years, and two rectangular ones for three years; and there is no sign of failure of the asphalte.

Fletcher W. Stevenson.

Coventry Gas-Works, April 11, 1911.

Public Lighting of Bournemouth.

Sir,—I notice a table on page 123 of your last issue which has been prepared by a Mr. Tomlinson-Lee. Whether the misleading nature of the figures with regard to the public lighting of Bournemouth is due to ignorance or to a deliberate desire to mislead, I cannot say; but on neither point can they reflect credit on a gentleman who should, apparently, from his official position, know better.

The electric arc lamps alluded to are nominally 1000-candle power each; but actually I should doubt if they yield 500-candle power. It may interest Mr. Lee to know that my Company recently offered to instal 2000-candle power (photometrically tested) high-pressure gas-lamps at a cost of £10 17s. 6d. each per annum in place of the present nominal 1000-candle power arc lamps, which are costing the Corporation (using their own electricity) £15 10s. per annum each.

It probably would not interest Mr. Lee to know that the cost of gas lighting given by him includes a very large sum for new gas-lamps, &c., whereas the cost of the electric lighting does not include any such figure. But why labour the question? If the figures are intended to mislead, they may be successful; for any other purpose, they are worse than useless.

H. W. Woodall,
General Manager, Bournemouth Gas and Water Company.

Bournemouth, April 13, 1911.

Co-Partnership Schemes in Gas Companies.

Sir,—In your issue of April 4, you published the figures relating to co-partnership and profit-sharing in some 28 gas companies. I regret to say that, in the press of work, the proof of these was not checked by me; and, as a consequence, the figures in the report from which you quoted are in some cases incorrectly stated.

I shall be grateful if you will kindly publish the enclosed correct figures for the four companies in whose return mistakes occurred in the proof; and also the corrected totals of the 28 companies.

Apologizing for troubling you in the matter.

E. W. Mundy,
Assistant-Secretary of the Labour Co-Partnership Association.

6, *Bloomsbury Square, W.C.*,
April 11, 1911.

[Enclosure.]

Name of Company.	No. of Years Scheme has been in Operation.	Amount Divided among Employees for Year ending Dec., 1910.	Total Profit to Employees since Scheme was Adopted.	Amount of Shares and Deposits held by Employees in the Company. Market Value on Dec. 31 1910 (about).
Commercial	10	£5433	£45,520	£49,164
Chester	9	289	2,206	1,793
Rugby	2½	190	620	620
Watford	1½	472	702	460
Totals for 28 companies		£88,812	£686,237	£597,775

Inquiries as to Pumping Water on Gas-Works.

Sir,—In our gas-works we have a receiving-tank from which a pump is delivering water at the rate of 4000 gallons per hour. The inlet-pipe to the tank is a 3-inch, fitted with a 3-inch valve outside the building and a 3-inch ball-cock inside the tank. Owing to the ball-cock failing to keep tight, it is necessary to shut the outside valve after every time of pumping, which is very frequent, and occasionally very inconvenient at times to do. Would it be possible to get a ball-cock to keep tight, and only pass water when necessary? If so, can any reader tell me what would be a suitable size to pass 4000 gallons of water per hour at 56 lbs. pressure on the inlet? I shall also be glad to know if it is considered advisable or necessary to shut the valve, even though the ball-cock was keeping tight. At present, there is nothing to indicate the amount of water the pump is raising. Would there be any advantage in getting a meter? If so, what would it be?

Inquirer.

April 10, 1911.

Increased Water Storage for Lostwithiel.—An inquiry was held recently by Mr. A. W. Brightmore, M.Inst.C.E., into an application made by the Lostwithiel Town Council to the Local Government Board for authority to borrow £1500 for the purpose of constructing a storage reservoir. The Town Clerk (Mr. P. Heath) explained that the present storage capacity was only 40,000 gallons, and the erection of the proposed reservoir would increase it to 120,000 gallons. In very dry weather, Lostwithiel was virtually dependent on a storage of 10,000 gallons; and meantime there was a stream running to waste. It was this water that the Council wanted to secure. They applied that the repayment of the loan might be spread over thirty years. Mr. R. Reed opposed the scheme on the ground that no attempt was made to get rid of the incrustation of the pipes and prevent its recurrence. A number of ratepayers also opposed the scheme because they considered it to be of a temporary character. The Town Clerk said the Council had always been in favour of a larger storage reservoir; and the only question had been whether this or the scraping of the mains should be the first work undertaken. At the close of the inquiry, the Inspector visited the source of supply and the site of the proposed reservoir.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

The following further progress had been made down to the rising of the House on Wednesday for the Easter recess:—

Bills read a second time and committed: Ashborne and District Gas Bill, Hastings Corporation (Water and Finance) Bill, Luton Water Bill, Swinton Urban District Council Bill.

Bill read the third time and passed: Gaslight and Coke Company Bill.

After the second reading of the Luton Water Bill, it was decided to instruct the Committee on the Bill to inquire whether the promoters had made adequate provision for the supply of water at reasonable rates to the agricultural community within the area of supply, and to any person or persons from whom any existing or natural supply was, or might be, withdrawn owing to the works or undertakings authorized by the Bill; also to insert such clause or clauses as they thought necessary to impose upon the promoters the obligation to provide such supply.

CHESTERFIELD WATER AND GAS BOARD BILL.

The Water Scheme.

The Committee of the House of Commons presided over by Sir HENRY KIMBER, Bart., have had under consideration for several days the portion of the above Bill dealing with the water undertaking. Authority is sought to construct further works to give a better supply of water to the district, the population of which is rapidly increasing.

Mr. J. D. FITZGERALD, K.C., and Mr. W. M. ACWORTH appeared for the promoters. The petitioners against the Bill were represented as follows: Mr. TALBOT, K.C., Mr. HUTCHINSON, K.C., and Mr. H. W. BEVERIDGE for the Duke of Devonshire; Mr. H. ST. JOHN RAIKES for the Duke of Rutland; Mr. JOSEPH SHAW, K.C., for millowners, manufacturers, and traders carrying on business on or near the River Derwent; and Mr. RAYMOND ASQUITH for the Derby Corporation.

The Case for the Promoters.

Mr. FITZGERALD, in opening the case for the promoters, said the Chesterfield Water Board was incorporated by Act of Parliament in 1895 for the purpose of acquiring the undertaking of the Chesterfield Water and Gas Company. They represented the Corporation of Chesterfield and the Urban District Councils of Newbold and Dunstan and Whittington. In addition to these areas, they also supplied a considerable district beyond. In 1825, the Chesterfield Water-Works and Gaslight Company were incorporated by an Act of Parliament, and authorized to construct a dam on the Linacre Brook, and, by means of a conduit, to take water into Chesterfield. The Company were dissolved and re-incorporated in 1855. In that year they obtained power to construct the Lower Linacre reservoir. This was the original reservoir for the purpose of supplying Chesterfield. In 1865, the population of the town having considerably increased, the Company obtained power to construct the Upper Linacre reservoir. Just before the Company's undertaking was taken over by the Water Board, there had been a succession of dry seasons; and, partly in consequence of this, there was a great shortage of water in Chesterfield. The Water Company therefore came to Parliament for power to construct a reservoir in another valley. The case they put before Parliament was that they could not build the additional works which were necessary for the supply of Chesterfield unless they got an enormous addition to their charging power. In these circumstances, the Corporation of Chesterfield and some adjoining districts opposed the Bill, and said that, if Parliament rejected it, they would come the following year with a Bill for the transfer of the water undertaking to the local authorities. The Committee accepted this undertaking, and rejected the Bill. Accordingly, the Chesterfield Corporation, in conjunction with the two local bodies, promoted a Bill in the next session to constitute themselves into a Water and Gas Board, and to enable the Board to acquire the works of the Company. This Bill passed into law in 1895. The new Board acquired the undertakings at the price of £231,850; and they called in Mr. W. B. Bryan to advise them with regard to the water supply. In 1904, the Board obtained powers from Parliament to construct the Middle Linacre reservoir. By means of these three reservoirs, the Board had utilized the whole of the Linacre watershed above the original reservoir. The total capacity of the three reservoirs was 243 million gallons. At the date of the transfer in 1896, the houses supplied by the old Company numbered 9247; at the end of last year, the number was 13,953. The population had risen from 47,000 or 48,000 in 1896 to approximately 70,000 at the present time. The increase was going on rapidly; and there was every indication that within twenty years the Board would have to deal with a population of 100,000. The scheme embodied in the Bill was divided into sections; so that one section only need be constructed at a time, as the demand for water increased. It was necessary to drive a tunnel through the ridge which divided the Linacre valley. Through this tunnel the water to be taken on the other side of the ridge would be carried into the Linacre stream, and would then find its way down to the reservoirs. At the end of the tunnel there was the Blackleach Brook; and it was proposed to put a dividing weir across this stream, and thus turn a certain quantity of water into the line of pipes which was carried through the tunnel. The dividing weir was so arranged that no water could be taken from the Blackleach Brook until 91,000 gallons per day were flowing down it, and until the excess over this amount was 2½ times the normal dry-weather flow. Along with this dividing weir it was proposed to construct a catchwater, which drained water from the moors and brought it down to the tunnel, so that it would flow to the Linacre reservoirs. The second instalment consisted of three catchwaters and two dividing weirs. In both cases the weir was so arranged that no water could be taken into the pipes unless 2½ times the normal dry-weather flow was going down the stream, and then only the amount in excess. In regard to the third stage, as the demand increased, the whole of the waters where the dividing weirs were would have to be impounded; and for the purpose of giving compensation to the stream, the Baslow compensation reservoir would be constructed. There were also supplementary works for carrying the water into Chesterfield; but they were not in controversy. The total cost of the proposed works was £155,254. The Board had very little doubt that they would be able to get the supply needed without increasing in any way the financial demand. Dealing with the petitions against the Bill, Counsel said that the whole of the watershed with which the Board were now dealing belonged to the Duke of Devonshire and the Duke of Rutland. Both these petitions really dealt with the question of compensation. The Duke of Devonshire had a lake, called the Emperor's Lake, not far from Chatsworth House, which was supplied by an artificial cut. The Duke's petition was presented on the basis that the Board were going to take away the supply from the lake. But this was not so. The other objection the Duke of Devonshire had raised was that the supply of water to his Robin Hood mill would be interfered with. If the supply was diminished, however, his Grace was entitled to compensation. The amount of damage done was very small, and could easily be remedied. The only other objection the Duke of Devonshire raised was as to a mill on the River Derwent. In regard to the Duke of Rutland, he was the owner of the whole of the gathering-ground now used by the Rural District Council, to whom he had sold all his water rights. Therefore, the effect of the scheme upon him was almost inappreciable. In his petition, he pointed out that when the whole of the water going into tributaries of the Blackleach brook was taken, and the compensation water was given from the Baslow reservoir, this compensation water would not come into the Heathylea brook. This was quite correct; and if the Duke was injured by the state of the Heathylea brook, he was entitled to pecuniary compensation. Subject to this, it did not appear that his Grace had any substantial interest in the matter at all. The other objection was that of the millowners on the River Derwent, who between them owned seven mills. But the amount of damage that could be done to any of these mills was very small indeed. After they had constructed the whole of the first two instalments, the watershed affected was 2·40 square miles. At the Edensor mill of the Duke of Devonshire (the first mill on the Derwent), the watershed draining to the mill was 140 square miles; at the next mill, the Matlock mill, it was 288 square miles; at Ambergate, it was 300 square miles; at Milford, 370; and Darley, 398 square miles. So that only an infinitesimal proportion of the watershed was being interfered with; and they would be told by the engineers that the amount of difference, supposing they were to take the whole of the water of these brooks, at these mills would be represented by about ½ H.P. Under these circumstances, he did not think the millowners had any case of substantial damage; but whatever the damage was, they ought to be compensated.

Mr. *Johnson Pearson*, the Chairman of the Chesterfield Water and Gas Board, gave evidence in support of the statement of the learned Counsel, and produced tables showing the increase in the consumption of water in Chesterfield during recent years. The general consumption had increased 50 per cent. In the autumn of 1905, there was only eight days' supply left in the two reservoirs belonging to the Board. They were advised that they ought to provide for a minimum consumption of from 22 gallons per head per day. He anticipated that the Board would get from this scheme 100 million gallons of water a year, or one-third of a million gallons per day. The Baslow reservoir was intended to compensate the Barbrook only; it would not join the Heathylea or the Blackleach. The compensation water provided in the Bill was 360,000 gallons a day. He did not consider the Duke of Devonshire would be injured if the water in the Blackleach brook were diminished. The water of the Emperor's Lake came from the Wadshelf brook.

In cross-examination by Mr. ASQUITH, witness said he was aware the Derby Corporation were the owners of the water undertaking, and that they obtained their supply under the Derwent Valley Water Board Act. They were not affected by what was proposed in this Bill.

Dr. *H. Peck*, the Medical Officer of Health for Chesterfield, gave evidence from a medical point of view in favour of the scheme.

Mr. *W. B. Bryan*, the Chief Engineer to the Metropolitan Water Board, said since the inception of the Chesterfield Water Board he had acted as their adviser; and it was on his advice that the Middle Linacre reservoir was constructed. The scheme embodied in the present Bill was practically identical with the one he recommended to the Board many years ago. He carefully considered the question of compensation water at the time, and came to the conclusion that the abstraction of water from the gathering-ground proposed in the scheme would do the minimum of injury to the stream below. The gathering-ground was a very steep one. It was bleak moorland, and the water passed rapidly into the Derwent. The amount of compensation water which would have to be provided would be of so minute a quantity that it would not represent more than ½ H.P. at any of the mills on the Derwent which had a 10 feet fall.

In cross-examination by Mr. TALBOT, witness admitted that the proposals contained in the scheme were somewhat unusual. No provision was made in respect of compensation water. He could not say there was no obligation to make the compensation reservoir at Baslow.

Mr. TALBOT: I gather you would not advise the Water Board to provide any compensation water at all?

Witness: I would not say that, because undoubtedly the time will come, and probably come rapidly, when the construction of a compensation reservoir will enable them to take the water in the summer time, when they want it most.

In further cross-examination, witness said he was not aware that the Barbrook reservoir was constructed without parliamentary authority, and that the seventh Duke of Devonshire agreed to waive any claim he had to compensation, either in water or money. It was on his advice that the Company took a temporary supply from the upper water of the Barbrook. There would be very little water obtainable

from the area in dry weather. The proposal was to take water in flood time, and to take none during droughts.

Mr. SHAW: By the present scheme you are taking water from the tributaries of the Derwent, and for 15 years you are not proposing any compensation?

Witness: Practically that is so.

Cross-examined by Mr. RAIKES: If the compensation reservoir were started at once, it would not take 15 years to complete it.

Dr. *S. Barwise*, the County Medical Officer of Health for Derbyshire, examined by Mr. ACWORTH, said he considered the Bill a desirable one. An increased supply of water for domestic purposes was much needed in Chesterfield.

Cross-examined by Mr. HUTCHINSON: At the present time, he considered the water supply of the town was half-a-million gallons per day less than the actual requirements. According to his calculation, in 1931 the population would be 102,000.

Mr. *B. W. Bryan*, the Engineer of the scheme, examined by Mr. ACWORTH, said he had drawn it up so that it could be carried out by instalments. The first portion of the work would be to lay the line of pipes to carry a supply from the Rural District Council. While this was being done, the Board would push on their tunnel through the hill, so as to draw water out of the Blackleach brook and the catchwater to the west. This was the portion for which the Board asked a five-year period. In the next five years, it was proposed to extend the catchwaters, and in the following five years to construct the compensation reservoir. The line of pipes would be completed by the end of the year; and the tunnel might be got through in two years. There was no special difficulty about the work, unless they met with bad material.

In reply to Mr. Talbot,

Mr. FITZGERALD said he would not agree to be put under an obligation to construct the compensation reservoir within ten years.

In reply to Mr. SHAW, witness said the catchwaters would intercept water which would otherwise have flowed into the stream.

Mr. RAIKES next cross-examined witness with the object of showing that the Duke of Rutland's rights would be injuriously affected by the proposal to take an increased supply of water from the Rural District Council reservoir by the line of pipes.

Mr. FITZGERALD said the Duke of Rutland had sold for good consideration in money his water rights to the Rural District Council, who obtained from Parliament the power to sell their surplus water to the Gas and Water Board. All they were asking for was to improve the facilities for exercising the powers Parliament had given them.

In cross-examination by Mr. ASQUITH, witness admitted that there was no obligation under the Bill to build the Baslow compensation reservoir; but he thought the Board would construct the dam in their own interests. In his opinion, there would be no difficulty in completing the Baslow reservoir in five years.

This concluded the case for the promoters.

The Case for the Opposition.

Evidence was called on behalf of the Duke of Rutland, who asked that if the powers sought were granted, and water was permitted to be taken away from the streams flowing into the River Derwent, a reservoir should be constructed before the draining process commenced, so as to give compensation water, which, it was contended, Parliament invariably decided must be provided in cases of this sort.

Mr. ACWORTH, in reply to a member of the Committee, said the promoters would be quite willing that a clause should be inserted in the Bill compelling them to guard the catchwater pipes at the gathering-grounds against rabbits or anything else getting into them and thus polluting the water.

It was stated at this stage that if the promoters and the opponents were allowed some little time to confer together, a settlement would probably be arrived at.

On the resumption of the proceedings the following day,

Mr. ACWORTH, on behalf of the promoters, stated that, as the result of a conference between there presentatives of the Duke of Rutland and the Duke of Devonshire, the basis of a settlement had been arrived at. They still had, however, to meet the opposition of the Derbyshire County Council, the Derby Corporation, the millowners, and the Baslow Urban Council. They could not say they were in a position to give the opposition everything they were asking for until they had had a further consultation. However, they had hopes that the settlement arrived at would be accepted by the other parties, and which would have to be the basis of clauses and alterations they would put before the Committee. Broadly, the settlement was as follows: It was agreed that the Board should take water through a line of pipes from Birley to Rawsley for four years without restriction, after which time for every 2 gallons the Board took down the pipes, 1 gallon compensation must be poured into the Barbrook. With regard to the Blackleach stream, they had agreed with the Duke of Devonshire upon a drainage area out of which they would take no water. They were to take five years for the construction of the first section of the catchment area—from Linacre round by Baslow and Ramsley. If the promoters made a tunnel between the Blackleach brook and Freebirch, they bound themselves to construct the reservoir, or not to take any water from the Barbrook until the reservoir was built. The compensation reservoir was to be completed within 15 years.

The CHAIRMAN said he thought the arrangement was a very reasonable one.

The Committee then adjourned for a week.

When the proceedings were resumed,

Mr. FITZGERALD stated that the terms agreed upon had been embodied in a clause, which had been sent to the opponents. He had, however, received an amended clause on behalf of the Duke of Devonshire and another on behalf of the Duke of Rutland.

The CHAIRMAN then suggested an adjournment to enable the parties to come to some agreement.

When the proceedings were resumed,

Mr. FITZGERALD said he believed everything had been agreed between the promoters and the Duke of Devonshire and the Duke of Rutland, and everyone else except the millowners and the Corporation of Derby. He believed Mr. Talbot, who represented the Duke of Devonshire, wanted to raise a question with reference to clause 3a, which had been inserted for the protection of the Chesterfield Rural District Council. As it was an agreed clause between the promoters and the Rural District Council, however, he, as representing the promoters, could not consent to any alteration in the absence of the representatives of the Council.

Mr. TALBOT said the Chesterfield Rural District Council constructed the Barbrook reservoir; and the Duke of Devonshire, as the riparian owner, gave up any claim to compensation, either in money or water. He did not ask the Committee to decide any question of right. His amendment to the clauses was merely to preserve the *status quo*, and to prevent any interference with the rights of the Duke of Devonshire. He claimed that, under the arrangement made by the District Council, they were not entitled to supply water from their reservoir outside their district except by leave of the Duke of Devonshire. As a matter of fact, when they were supplying a neighbouring Council, they went to the Duke, who offered no objection; and the District Council expressed themselves satisfied and grateful to his Grace for the way in which he met them. The arrangement was that they were to pay the Duke a nominal sum of 1d. per 1000 gallons for water so supplied. He did not ask the Committee to incorporate this agreement in the Bill. It would be seen that the clause provided that nothing in the Act contained should prevent the District Council extending their water-works at Barbrook or elsewhere. He feared that if the clause passed as it stood, it would be relied upon hereafter by the District Council as appropriating to them this catchment area. He asked the Committee to insert a provision to the effect that nothing in this section should in any way prejudice or void any right as riparian owner possessed by the Duke of Devonshire in the proposed catchment areas, streams, and waterways. The clause asked for provided, in fact, that any right now possessed by the Duke of Devonshire must be preserved.

Mr. FITZGERALD, in reply to the Chairman, said the agreement with the District Council was come to after they had lodged their petition against the Bill. They had been in negotiation with the Chesterfield Water and Gas Board; and the result was the clause the promoters had agreed to insert in the Bill. Having agreed to this, they were bound not to alter it themselves, and to do all they could to prevent anyone else altering it. The clause conferred no new right on the Rural District Council. It simply confirmed their existing rights. There was nothing in the clause which affected the rights of the Duke of Devonshire.

The CHAIRMAN drew attention to the wording of the clause, which authorized the Rural District Council to extend their water-works at Barbrook and elsewhere within the particular catchment area of the Council.

Mr. FITZGERALD said the Council already possessed this power. The object of the clause was to obviate any possible construction of the Act which would take away from them any rights which they now possessed. There was not a single word in the clause which affected the rights of the Duke of Devonshire. His Grace had agreed to every provision in the Bill by which his rights could be affected. The clause conferred no rights of any kind upon the Rural District Council except such as they possessed at the present moment. There was therefore no necessity to insert anything about the Duke of Devonshire or the Duke of Rutland.

After further argument, the Committee refused to accept the clause proposed by Mr. Talbot on behalf of the Duke of Devonshire.

Mr. H. R. CRIPPS, on behalf of the millowners, asked that an obligation should be put upon the promoters to immediately construct a reservoir for the supply of compensation water to the stream. Under the terms of the agreement arrived at, they were to be allowed to take water from the stream for a period of four years without payment or obligation of any kind. After this, they were to take two-thirds of the water and leave one-third to the millowners, which they called compensation water. It was not compensation water at all, because it already belonged to the millowners.

Mr. FITZGERALD said the promoters had already agreed with the Duke of Devonshire, the owner of the mill highest up the stream, and obviously the millowners lower down would obtain the benefit of any arrangement made with his Grace.

The Committee declined to accept the proposed clause.

The agreed clause was added to the Bill; and the remaining clauses having been adjusted, the measure, as amended, was ordered to be reported.

Reductions in Price.—The Coalville Urban District Council have reduced the price of gas to private consumers from 4s. 2d. to 3s. 9d. per 1000 cubic feet, and to users of gas for power purposes by a further 5d. The Lincoln City Council have decided to reduce the price of gas 1d. per 1000 cubic feet (from 2s. 1d. to 2s.) from Michaelmas next, and to increase from 10 to 12½ per cent. the discount to prepayment meter consumers.

Barnsley Public Lighting.—The Barnsley Town Council have agreed to spend £16,100 on extensions at the electricity works, and to defray the cost of the lighting of the town by electricity, instead of gas as at present. Alderman Brady, the Chairman of the Electricity Committtee, said they had come to their decision after taking the advice of one of the highest experts; and they believed this expenditure would cheapen the cost of production, yield a large amount to the rates, and give an infinitely better light for the town.

Sales of Stocks and Shares.—At a recent sale by auction, £7500 of ordinary stock (5 per cent.) of the Rochester, Chatham, and Gillingham Gas Company, offered in lots of £50 each, fetched from £55 to £55 17s. 6d. per lot. An issue of £14,000 (nominal) of ordinary share capital of the Peterborough Gas Company, in £10 shares, was disposed of at a recent sale by auction at prices ranging from £15 2s. 6d. to £15 12s. 6d. per share. At a recent sale, £2000 of additional stock (6 per cent.) of the Seaham Harbour Gas Company fetched prices ranging from £105 to £106 10s. per £100. Messrs. C. & B. Westbrook recently conducted in the Pump Room, Tunbridge Wells, a successful sale of stock of the Tunbridge Wells Gas Company. Nearly £4000 of stock changed hands at very satisfactory prices.

MISCELLANEOUS NEWS.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

Half-Yearly Report.

At the Half-Yearly General Meeting of the Association on the 2nd prox., the Directors will present the following report, which is accompanied by the accounts, on the results of the Association's operations in the six months ended Dec. 31.

The profit of the half year was £272,030, which, together with the sum of £16,548 brought forward from the account of the previous half year, makes a total of £288,578 available for appropriation, as compared with £247,298 for the corresponding period of 1909. This increase in the profit for the past half year is mainly due to the circumstance that the accounts for that period include the dividend of £36,000 received from the Association's investment in the Frankfort Gas Company. This Frankfort dividend is for the year March, 1909, to April, 1910, and was only declared and paid in the course of the half year under review.

The proprietors will observe from the balance-sheet that the policy, approved by them at the last half-yearly general meeting, of writing-down to their market value the 2½ per cent. Consols which represent the reserve fund, has been continued by the appropriation of £20,000 for this purpose from the profit of the half year.

The total output of gas in the various towns directly supplied by the Association showed an increase of 7·11 per cent., and the number of consumers increased by 9·07 per cent.

The total number of meters in use at the close of the past half year was 532,356, of which 138,506, or 26 per cent., were prepayment meters. At the end of December, 1909, the total number of meters was 489,140, of which 123,603, or 25·44 per cent., were prepayment meters.

The total length of mains laid up to the 31st of December last was 2362 miles—an increase of 67 miles since June 30, 1910.

The plant and mains at all the stations have been maintained in their usual efficient condition.

The quantity of coal carbonized in the half year was 522,103 tons, at an average gross cost of 17s. 11d. per ton, or 4½d. per ton less than in the corresponding half year; but, owing to a considerable fall in the value of coke, the net cost of the coal showed an increase of 2d. per ton. Tar also declined in value; but ammonia products showed an improvement.

At Antwerp two additional lime purifiers for water gas were installed on the works at Berchem, and an additional water reservoir was constructed on the Hoboken works.

At Berlin, the new retort-house on the Holzmarktstrasse works, containing eight benches of 18 vertical retorts each, with coke conveyor, was completed; and further progress was made with the enlargement of the apparatus house on the Mariendorf works.

On the Weissensee works, three more vertical retort-benches of 18 retorts each were completed, and progress was made with the erection of a new 20,000 cubic metre gasholder with three lifts (in a wrought-iron tank, 30·6 metres in diameter). The contract with the commune of Rosenthal, situated to the north of Berlin, was prolonged for ten years—from 1960 to 1970.

At Brussels, the construction of the foundations and the steel tank for the 100,000 cubic metre (3½ million cubic feet) four-lift gasholder was proceeded with; and the new electricity station at Droogenbosch was nearly completed.

An agreement was come to with the suburban commune of Etterbeek, for the extension of the term of the Association's gas monopoly by twenty years—*i.e.*, from 1924 to 1944.

At Hanover, five benches of 18 vertical retorts each were completed and put in action.

At Argenton, one of the towns in France supplied by the Compagnie Continentale du Gaz, the monopoly for the supply of gas to the suburb of St. Marcel was secured until 1940.

At Meaux, another of the same Company's stations, agreements were concluded for the supply of gas and electricity to the suburbs of Nanteuil and Villenoy until 1938.

A contract was also concluded until 1948 for the exclusive supply of gas to Pont Trambouze, a small town in the neighbourhood of Thizy, another of the stations of the Compagnie Continentale.

WESTMINSTER PUBLIC LIGHTING.

The City Engineer's Testimony to the Success of the High and Low Pressure Gas Lighting.

At the Meeting of the Westminster City Council last Tuesday, Mr. Lyon Thomson presented the report of the Works Committee, which contained a reference to the completion of the installation of the high and low pressure gas lighting in the city by the Gaslight and Coke Company. Mr. Thomson has been acting as *locum tenens* for Mr. Jacques Abady, the Chairman of the Committee, during his absence in India; but before the return of the latter gentleman, his colleagues did him the honour of re-electing him.

Mr. Thomson, in the name of the Committee, gave to Mr. Abady a very hearty welcome home again; and, in moving the subjoined paragraph of the Committee's report, asked to be allowed to make a remark on the great change which had been effected in the lighting. He was very glad to see Mr. Abady back again, because he was largely responsible for initiating the change. The members of the Council had had the report of the Engineer circulated to them, and they would see from it that the lighting was well above the guaranteed minimum. He (Mr. Thomson) thought all their most determined opponents, who took such an active part in opposing the scheme in the early stages, had changed their views; and he had heard complete satisfaction expressed by the ratepayers in every part of the city. The Committee had testified to the Engineer their appreciation of the very considerable trouble he had taken in the matter, and had complimented him on the success he had achieved. The paragraph of the report (which was adopted) was as follows:

> We have received a report from the City Engineer of the satisfactory completion by the Gaslight and Coke Company of the installation of high and low pressure incandescent gas lighting under their contract for public lighting of the 23rd of May, 1910. A copy of the report has been forwarded to each member of the Council. We have expressed to the City Engineer our appreciation of the satisfactory way in which the installation of the improved public gas lighting in the streets of the city has been carried out.

Mr. Bradley's Report.

The report referred to in the foregoing, by the City Engineer and Surveyor (Mr. J. W. Bradley, M.Inst.C.E.), stated that the Gaslight and Coke Company had carried out in a satisfactory manner in all respects the terms of their contract for the installation of incandescent high and low pressure gas lighting in the areas of the city covered by the contract. Mr. Bradley proceeds:

"In accordance with the terms of the contract, I have carried out a number of tests of the various lighting units during the past three months, which will show that the contract has been executed in a satisfactory manner. Results of the tests are as per Schedule A.

"Occasionally a lamp is found, by reason of a defective mantle, or some other circumstance, to give a light below the minimum specified candle power; and from the 1st of April onwards the contract will be strictly enforced, and the contractors penalized in accordance with the terms thereof.

"Schedule B gives a description of the different types of lamps, the number of such lamps, the cost of installation, and the annual cost of maintenance. Your Committee will see from this schedule that the cost of installation has amounted to £5018 7s. 6d.; and the annual cost of maintenance is £13,381 12s. 6d. Based on the minimum candle power specified, the cost per candle power per year of 3940 lighting hours is 4·24d. Based on the present ascertained illumination, as measured at specified angles, the cost for a lighting year of 3940 hours is 3·57d. per candle power per annum.

"Your Committee will, I venture to believe, regard these results as entirely satisfactory; and from the complimentary references which have been made in the English, American, and Continental Press to the public lighting, both gas and electricity, of the public streets and open spaces of the City of Westminster, the Council need not fear comparison with any other Metropolis in such matters."

Schedule A.

No. of Each Type of Lamp Erected.	Description of Lamp. Candle Power Units.	Tests Made.	Average Candle Power per Lamp.	Average Excess Candle Power over Minimum.	Average Percentage over Minimum.
20	3000 H.P. gas	51	3274	274	9·13
171	1800 H.P. ,,	57	2016	216	12·0
267	300 L.P. ,,	13	361	61	23·3
969	180 L.P. ,,	15	202	22	12·2
1485	90 L.P. ,,	14	132	42	46·6

Total excess candle power over specified minimum, 142,393, which is equal to 18·8 per cent. excess.

Schedule B.

Type. C.P.	No.	Description.	Cost of Installation.	Cost of Annual Maintenance.	Total Costs of Annual Maintenance.
			£ s. d.	£ s. d.	£ s. d.
90	835	New lamps on old columns at 25s.	1043 15 0		
	650	Lanterns converted, at 7s. 6d.	243 15 0	2 16 6	4,195 2 6
	1485				
180	962	New lanterns on old columns, at 25s.	1202 10 0		
	7	Lanterns converted, at 12s. 6d.	4 7 6	4 10 0	4,360 10 0
	969				
300	143	New lanterns on old columns, at 30s.	214 10 0		
	124	Do., on new columns, at £4	496 0 0	6 10 0	1,735 10 0
	267				
1800	63	New lanterns on old columns, at 50s.	157 10 0		
	7	Do., in new positions, at £5	35 0 0		
	44	Do., on arc columns, at £10	440 0 0	15 10 0	2,650 10 0
	53	Do., on new columns, at £17	901 0 0		
	4	Do., at £20	80 0 0		
	171				
3000	20	New lamps on existing arc columns, at £10	200 0 0	22 0 0	440 0 0
		Grand totals . .	£5018 7 6	..	£13,381 12 6

HOLBORN PUBLIC LIGHTING.

A Truce and a Surprise.

At the Meeting of the Holborn Borough Council last Wednesday, one of the items on the *agenda* referred to the tenders received for the public lighting of the borough. This was the outcome of instructions issued by the Council at a meeting on the 14th ult., when, as recorded in the "JOURNAL" at the time, they declared, on the report of the Works and General Purposes Committee, that they had come to the conclusion that the proper course for them to take was "that fresh tenders be invited from the Gaslight and Coke Company and the Metropolitan Electric Supply Company, Limited (representing the Electric Light Companies having powers of supply in the borough), upon a specification and tender form prepared by the Town Clerk and the Borough Surveyor." It will probably be remembered by our readers that the lighting was to be in accordance with a "graded" list of streets arranged by the Committee.

When the item was reached, Alderman Nolan Glave proposed, and Mr. Angel seconded, that the tenders be referred to the Works Committee. The Town Clerk (Mr. Lionel Walford) replied that there was only one tender—no other having been received—and that there was an endorsement upon it that "the two tenders are on one sheet of paper from both companies." No other tender being forthcoming, the Council, when it recovered from its surprise, agreed, by way of an amendment, on a vote of 21 to 6, that the tender be opened and read by the Town Clerk.

The tender was then opened. It contained a letter addressed from the Gaslight and Coke Company, dated April 11, 1911, stating that careful consideration had been given to the request of the Borough Council to submit tenders, and that it had been found necessary for the Companies to confer. As a result of the conference, they found they were unable to tender separately for the public lighting of the borough; but they made a joint tender amounting to £6950, which was somewhat less than the amount quoted in February last. They had filled in the joint tender according to the schedule supplied, and submitted the offer for a ten years' contract, with specific sums payable by the Council if they desired to terminate the contract earlier. They also stated that they were unable to submit to the penalty clauses, and that if the Council insisted upon them they would have to increase the prices by 10 per cent. They were also unable to supply new burners, &c., owing to any improvement or advancement that might take place in lighting, unless the Council agreed to bear the cost; and that, though the total price was somewhat lower than the previous figures, the candle power proposed to be given was somewhat in excess of that originally proposed. The letter was signed by both Companies.

Alderman Max Clarke said that the joint tender was out of order, as it did not comply with the specification; and he moved that it be not accepted. This not being seconded, Mr. Fitz-Roy Doll moved, and Mr. Angel seconded, that the joint tender be referred to the Works Committee for consideration, and for them to report to a Committee of the whole Council *in camerâ*, so that the figures contained in the tender should not be made public. Mr. Motion said he did not agree with this suggestion. He thought that the utmost publicity should be given to tenders, and that in this case there was no longer any need for secrecy, as, the two Companies being now joined together, no harm could come to either of them by the publication of the figures.

Several councillors were in favour of the joint tender being referred direct to the Council for consideration; but it was eventually decided that a special meeting of the Council should be called to consider the matter, as soon as the Works Committee had prepared their report.

A correspondent has sent us the following observations on the subject referred to in the preceding report:

There have been many surprises in connection with the public lighting contracts of the various lighting authorities in the Metropolis during the past year, but neither the Holborn Borough Council nor the public generally were quite prepared for that which awaited them last Wednesday, when the Council met to open tenders for the lighting of the thoroughfares within the Borough; for instead of two separate tenders from the competing Companies, who have had a stiff fight during the last twelve months, it was found that only one tender had been received, and that a joint one in the names of the two Companies—viz., the Gaslight and Coke Company and the Metropolitan Electric Supply Company, Limited.

It will perhaps be of interest to go back to what took place in March last, when the Council—after many "delays," "referrings-back," and "reconsiderations" *ad nauseam*, including the publication of the figures of both Companies—finally decided that they had come to the conclusion that the proper course to take was to invite fresh tenders from the Gaslight and Coke Company and the Metropolitan Electric Supply Company, Limited. Thus both Companies were placed at considerable disadvantage to each other. It was only natural that there would come a time when the calling for "fresh tenders" would cease, and the game of "Dutch auction" come to an end, if the Companies were to have any consideration for their shareholders' interests; for the question of profit on the contract was fast approaching the vanishing-point, and for self-protection no other course was really open to them but to "confer."

What the ultimate result of this novel procedure may be, one cannot at this juncture anticipate; but it is satisfactory to know that the Companies have taken no undue advantage of the situation created, and that the Council, if they accept the present terms of the Companies, will be getting their public lighting at a cheaper rate than the last offer, with a total illuminating power in excess of that asked for. The whole position is certainly unique; and the progress of the matter, and the ultimate outcome, will be watched with close interest.

LONDON COUNTY COUNCIL'S COAL AND COKE SUPPLY.

Council Seek Advice of Mr. D. Milne Watson.

At the Meeting of the London County Council last Tuesday, the Stores and Contracts Committee presented the following report on the subject of the supply of coal and coke for the year 1911-12: "The Council on the 14th of March decided to obtain from an expert a report advising, from a commercial point of view, whether the Council's method of buying coal could be improved, and, if so, in what respects. Under this authority, we have arranged with Mr. D. Milne Watson, the General Manager of the Gaslight and Coke Company, to furnish the Council with such a report; and Mr. Watson has been supplied with information as to the working of the present system. The preparation of the report will take some time; and in the meantime it is necessary to make preliminary arrangements for the contracts to be entered into for the supply of the coal and coke required after the 30th of June, when the current contracts expire. In the circumstances, the suggestion has been made that, without prejudice to any decision to be come to when the expert's report on the whole question is received, the Council might this year, as an experiment, invite quotations from collieries for the supply of a portion of the house coal required; quotations being at the same time obtained for the unloading, cartage, and delivery of the coal. We have consulted Mr. Watson on the proposal, and he advises, in effect, that an experiment of the character suggested is practicable and might be tried, and, in addition, makes certain suggestions as to the method in which it could best be carried out; and we propose that arrangements should be made accordingly. The quantity involved would be relatively small—say, about 7000 tons." The Committee recommended that, as an experiment, they should be authorized to make arrangements for obtaining direct from a colliery or collieries a portion of the house coal required during the year 1911-12. The recommendation was adopted without discussion.

MYSTERY OF A MANCHESTER EXPLOSION.

No Evidence of Gas being the Cause.

An inquiry held by the Manchester City Coroner on Wednesday last week, as to the cause of an explosion at the works of Messrs. James Laing and Co., Ancoats, by which three men lost their lives, failed to elucidate anything definite as to the origin of the explosion. Several officials from the Gas Department of the Manchester Corporation were present to give evidence.

Mr. Arthur P. O'Kell, Overseer for Messrs. Laing and Co., who are starch and gum manufacturers, said the equipment of the works included four gas-engines; and there were at the time of the explosion between 28 and 30 tons of coal stored on the premises. The firm used in their business practically all the commercial starches, a small quantity of ordinary flour, and a very small amount of hydrochloric acid. He was unable to offer any explanation as to the explosion. He did not think starch in any of its forms was capable of exploding on contact with flame. He had heard of flour-dust explosions; but theirs was mostly starch dust, and he had never heard of a starch-dust explosion. The most dusty place in the works was the bulking room. He had found the air there so impregnated with starch dust that he could not see more than 6 feet in front of him. The gas was on all the time; and there was no explosion. Several of the workmen who were on duty at the time of the explosion said they noticed no smell of gas about the place. The explosion occurred about midnight—just after the men had had supper. William Cardwell, Inspector of Gas-Fittings for the Corporation, said that he examined the gas-fittings at the works after the explosion, and found nothing to suggest that gas was the cause. The gas-bag of the engine in the room was intact and in working order. If there had been an explosion of gas, this would have gone. James Ramsden, the Street-Mains Surveyor for the Corporation, and John Barber, Foreman Gas-Mains Inspector, gave similar evidence.

The Coroner, in the course of his summing up, said it was clear there had been an explosion, followed by a sheet of flame which swept the whole of the building from basement to roof. This seemed to indicate that there was something there of a highly inflammable nature. The evidence showed that starch dust had never been known to explode; and he supposed no one doubted this. It was known, however, that under certain conditions flour dust mixed with air became inflammable, and might explode. Then it was suggested that the explosion might have been caused by gas; but there was the remarkable thing about it that of the eight men working there five who survived had given evidence, and not one of them noticed the slightest smell of gas or anything unusual. There was no direct evidence as to where the explosion originated; and it was for the Jury to state their view of the matter.

The Jury returned a verdict of "Accidental death" in each case; and added that there was nothing in the evidence to show negligence on the part of Messrs. Laing and Co.

The Coroner considered it a great pity that the cause of the explosion had not been ascertained, and said possibly the Home Office might take further steps with a view to elucidating the mystery.

Lead Contamination of Bakewell Water.—The Medical Officer of Health for the Northern District of the Bakewell Rural District Council having on various occasions reported that patients whom he had attended within the area of the Stoke Flat water scheme showed symptoms of lead poisoning, and that the water was suspected, samples were forwarded to the Derbyshire County Analyst; and the result showed that the suspicions were well founded. The water gathered from the Derbyshire hills was held to be causing all the trouble; and the Rural District Council took immediate steps to remedy the evil. Lime was used as a temporary expedient; but at the same time the Council decided to construct filter-beds at the source of supply. The Local Government Board having approved of the outlay, the Council have resolved to enter into a contract, and have the filter-beds constructed.

ASPHYXIATION BY GAS.

Use of Carburetted Water Gas in Manchester.

"Accidental asphyxiation by escaping gas" was the verdict of the Coroner's Jury in the case of Mrs. Esther Counsell Roberts, who was recently found dead in the bath-room of her residence at School Hill, Cheadle, near Manchester. The lady lived alone, and as a strong smell of gas was detected escaping from the house she occupied, and no response was obtained to repeated knockings, an entry was made, with the result stated. Henry Chesters, a plumber, said the geyser from which the bath was filled was heated by a bunsen burner, which had a pilot-light. The burner was turned on a little, and gas escaping. Dr. Jackson, who made a post-mortem examination of the body, said there were all the evidences of poisoning from carbon monoxide. The poison would bring on dizziness, and Mrs. Roberts would fall down and remain unconscious up to her death, which was due to asphyxiation. Answering a Juror, witness said carbon monoxide, or water gas, was more dangerous than ordinary coal gas. Manchester gas, which was supplied to consumers in the Cheadle district, was, he believed, mixed water and coal gas. The fact that carbon monoxide had no odour of its own, made it particularly dangerous; and in some places its use was prohibited.

The attention of Alderman Gibson, the Chairman of the Gas Committee of the Manchester Corporation, having been called to these remarks, he said: "The carburetted water gas we make is as pungent, and gives just as much odour, as ordinary gas. The small quantity we put in for illuminating purposes does not make it one bit more dangerous than it would be if we put in none at all. There are places where they do not burn anything else but carburetted water gas pure and simple. I should think we in Manchester use a less percentage than any other carburetted gas plant in the country, and there are scores of them. As a matter of fact, Manchester is in a better position than most towns in the country with regard to carburetted water gas."

THE DEBT OF LONDON IN 1909-10.

At the Meeting of the London County Council last Tuesday, the report presented by the Finance Committee contained the following references to London's debt.

In continuation of returns presented to the Council in previous years, the Statistical Officer (Mr. E. J. Harper) has prepared a return relating to the debt of the various London local authorities, showing for each Metropolitan borough and poor-law union the debt outstanding on March 31, 1910, and the annual charge on the rates in that year in respect of such debt, together with an analysis of the total net debt of London according to the source of borrowing and the nature of the services for which loans have been raised. The return deals with the entire debt of London secured on the rates, with the exception of that incurred by the Conservators of Wimbledon and Putney Commons and other special bodies not having power of rating over an entire parish. The main object is to show for what proportion of the total debt of the several local authorities the rates of the various parts of the Administrative County of London might ultimately become liable, and whether or not such debt actually results in a charge upon the rates at the present time, and also to show the actual burden borne by the ratepayers.

The aggregate net debt of London secured on the rates on March 31, 1910, was £111,043,088. The total net debt on March 31, 1909, was £110,621,565 (adjusted from £110,621,600, appearing in our report upon the last return)—an increase of £421,523. This is considerably less than the increase of the previous year, which was less than half of the increase of the year before that. A sum of no less than £2,653,369 was paid off, or set aside for the redemption of debt during the year 1909-10, either out of rate or out of the net revenue of revenue-producing undertakings; and, in addition, there were a few special repayments of unspent balances of loans, and certain sales of surplus property. These repayments and the proceeds of the sales have not been included in the return. The addition to the net liabilities therefore represents the creation of fresh debt to the aggregate amount of about £3,100,000. It will be seen, however, that a large part of this debt has been incurred for revenue-producing services. The total net debt in its relation to the rateable value of London shows a reduced percentage. On March 31, 1910, the net debt was equivalent to 253·61 per cent. of the rateable value of London, whereas on March 31, 1909, it worked out to 254·28 per cent.

It is essential to consider how much of the total net debt involves a burden on the ratepayers. For example, although the charge for interest and repayment on the total net debt amounted in 1909-10 to £6,190,732, only £3,903,189 was borne by the rates, equivalent to a rate in the pound of 1s. 9·22d. (against 1s. 9·31d. in 1908-9); the remaining sum of £2,287,543 being a charge on the net revenues of various undertakings which are for the most part carried on with little or no charge on the rates. The total charge on the rates during the year 1909-10 shows an increase of £11,932 compared with that of the previous year; but the equivalent rate in the pound of this charge has decreased by 0·10d., and is the lowest in any year since 1902-3.

The net debt attributable to revenue-producing undertakings is upwards of 50 per cent. of the total, and shows an increase in total over the figures for the previous year of £1,374,909. The particulars are—

Water supply (Metropolitan Water Board, London's rateable proportion)	£39,678,223
Tramways (London County Council)	8,899,099
Electric lighting (Metropolitan Borough Councils)	5,468,409
Working-class dwellings (London County Council and Metropolitan Borough Councils)	3,291,669
Miscellaneous	26,649
	£57,362,049

The revenue of each of these undertakings constitutes the primary security for the loans raised therefor; and the liability of the ratepayer for debt charges is only a contingent one. So long as equilibrium is preserved between revenue and expenditure, including the charges for interest and repayment of the capital, no charge will fall on the ratepayer. The two most important revenue-producing undertakings (water and tramways) have not so far necessitated a charge on the rates; although it would appear that the revenue of the Metropolitan Water Board may not in future be sufficient for the Board's purposes without recourse to the rates.

The total net debt outstanding on rate services on March 31, 1910, was £53,681,039, or 121·58 per cent. of the rateable value. It involved a charge on the rates in 1909-10 equivalent to 1s. 9·08d. The total sum provided in that year for the repayment of debt on rate services was no less than £2,130,514. The following figures for the past three years show that this portion of the net debt has steadily decreased: March 31, 1908, £55,434,005; 1909, £54,634,425; 1910, £53,681,039.

GAS WORKERS AND TRADE UNIONISM.

A meeting was held some days ago, in St. Martin's Hall, Liverpool, under the auspices of the local branch of the National Union of Gas Workers and General Labourers; the chair being occupied by the President of the Liverpool Trades and Labour Council.

Mr. F. Eccles, Assistant-Secretary of the Lancashire District, said that for the last fifteen years Liverpool had been looked upon as the black spot of Trade Unionism. They had tried many times to induce the gas workers of Liverpool to come into the national organization, but without success. A welcome change had, however, taken place within the last month or two; and he was happy to say that at the present time 50 per cent. of the men who worked inside the gas-works belonged to the Union. The Union had also made much progress in other parts of Lancashire; the total membership now standing at 40,000. They had 2000 members in Lancashire; and the increases in the rate of pay for the various classes of work brought about by the Union represented no less a sum than £14,000.

Mr. Will Thorne, M.P., the General Secretary of the Union, remarked that if there was one body of men who needed organizing more than another, it was the "bottom dogs"—the general labourers. They had to do all the hard and dirty work, and received the smallest amount of pay. Turning to the position of gas workers, he said that a good deal of the machinery introduced had not reduced labour, but had resulted in the men having to work very much harder. If they compared municipal gas departments with private companies, they would find in most cases that the wages paid by private companies did not compare favourably—their conditions were very much worse, and the price of gas was very much higher. Therefore it was to their advantage to be employed by municipalities rather than by private companies. In regard to Liverpool, he gave the Company the credit of adopting an eight-hour system even before the Union was formed. Trade Unionism no longer confined itself to "raising wages and decreasing working hours." They had found it necessary to turn their attention to politics. He was inclined to think that Trade Unionism could accomplish more as a Trade Union than by political machinery in the House of Commons, because, after all, under present conditions, their political machinery was very cumbrous; and they were hemmed in on every side. If the Unions were dissolved, they might depend upon it that wages would be lowered, hours of labour increased, and many of the privileges secured by their organizations would be taken away from them.

A QUESTION OF PREFERENTIAL TREATMENT.

It seems that the Chairman of the Aldershot Urban District Council Electricity Committee (Mr. C. A. L. Calvert) was a little unfortunate last week when he drew the attention of the members of the Council to what the Aldershot Gas Company have recently been doing. Some time ago, he said, the relationship between the Council and the Company was not of a very amicable character; but since then consultations and meetings had led to a more friendly understanding. He was astonished, however, to find the Company now making an offer of a reduction to people who did not use electric light. He heard that there was a reduction to users of gas-stoves; and he applied for the reduction, and thought he would have the same benefit as other users—especially as his consumption of gas and electric light was about equal. But to his surprise, he was informed that, because he used electric light in the house, a reduction could not be made. He did not think this was a continuance of the friendly relationship. It seemed to be a boycott of the electric light users; and he would like to ask the Clerk if it was permissible. The Clerk promised to look up cases.

That the Electricity Committee should be the last to complain of the Gas Company's policy in offering a preferential discount to users of gas-stoves provided gas is employed for lighting in the same building, is evident from the following extract taken from an editorial comment on the matter in one of the local papers: "We fear Mr. Calvert has forgotten that his Committee are doing the same thing—and, as a matter of fact, set the example. The Gas Company are simply following the lead. About two years ago, the Electric Light Committee submitted the following report to the Council: 'The Lighting Committee recommend that, on and after Oct. 1 next, a flat-rate of 3d. per unit be charged for all energy consumed by arc lamps used for externally lighting business premises, provided that such premises are lighted internally by electric light, and that each consumer provides a separate circuit and pays 2s. per quarter for hire of the meter necessary to register the special consumption.' The recommendation was agreed to. This means an abatement of 40 per cent. The Gas Company are giving 20 per cent. discount. In the face of this, what can the Council or anyone else say? Maybe the councillors did not realize what the adoption of such a report would lead to. Of course, the Electric Light Committee are purely a trading concern in the matter of lighting; and they must put up with the consequences if they try to 'go one better' against a rival in a similar way of business."

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

On Monday, at the Perth Town Council meeting, Mr. Allan is reported as having raised the question of the employment of municipal employees in connection with the recent taking of the census. Replying to Mr. Allan, Mr. Clark, the Convener of the Gas Committee, said that his attention had been called by Councillor Wright to the fact that several employees of the Gas Department had assisted in taking the census. He communicated with the Gas Manager on the subject, and learned that four employees were thus engaged, and that there would be a deduction from their wages corresponding to the time that they were off duty. Subsequently, however, he ascertained that there were employees in other departments similarly engaged, including several from the Gas Treasurer's office. While the Gas Manager had not paid the hands in his department for the time they were off duty, the Gas Treasurer, in spite of an assurance which he (Mr. Clark) had given at a meeting of the Gas Committee, had paid the members of his staff. In these circumstances, he wished to know whether an official assurance given by a Convener to his Committee was to be of no weight, and officials, in the face of such an assurance, were to act contrary to it. There was a discussion upon the subject; and then Mr. Clark gave notice of a motion for the next meeting, to the effect that before any employee should be permitted to absent himself from duty without deduction of wages or salary, for the purpose of doing work for which he was also to be paid, the consent of the responsible Committee must be first obtained.

On Tuesday and Friday of this week, there were letters published in the "Glasgow Herald" to which I may call attention. The first, on Tuesday, was written by Mr. R. Barclay Murdoch, and was dated from Brooklands, Johnstone. The writer asked if any of the readers of the newspaper could in any way assist in forming a collection of articles of any kind relating to William Murdoch, the inventor of steam-carriages and gas lighting, whom he described as "a much neglected genius;" the collection to be exhibited in the forthcoming National Historical Exhibition in Glasgow. Messrs. Tangye Brothers, of Birmingham, he said, had collected a number of little things more or less associated with Murdoch; and he was hoping that they would see their way to lend at least some of them. He thought there ought to be a large number of articles of various kinds still in existence connected with Murdoch and his family which would be of interest to many, and which would arouse interest in others. He is hoping that the day is not far distant when better justice will be done by Scotsmen to the memory of this one, who did far more to promote our national prosperity than many who have been extolled and commemorated. Mr. Murdoch adds that his name is the only connection he can claim with this great Scotsman.

To the second letter, also published on Tuesday, the signature is the anonymous one of "Hygiene." The writer states that, in view of the earnest appeals to the public by the Corporation to do what they can by adopting smokeless fuel for cooking and heating purposes, he should like to know if the Corporation are doing the best they can to encourage the public in this matter. In some towns, corporation gas cooking-stoves are provided free of all costs to the users, and in others at much lower rates than in Glasgow. If free cookers were given, he did not think it would interfere with traders, as they are unable to deal with cooking-stoves when hired out. Yesterday, there was another letter in the "Herald," also from an anonymous writer, who stated that he occasionally uses "Coalexld," which he requires to kindle by means of a gas "poker." He mostly, however, uses gas; and he finds it to be no dearer than, and much preferable to, coal for cooking and heating. He pleads, however, for a reduction of the price of "Coalexld" from 18s. per ton, which is now charged.

Parties from Kirkcaldy have been in London this week endeavouring to obtain an amendment upon the award of the Oversman—Lord Shaw of Dunfermline—in the case of the Kirkcaldy gas transfer. The Town Council met on Wednesday evening, and a telegram was read from Bailie Wright, the Convener of the Gas Committee, in which it was intimated that the Oversman would give his final decision in a few days, but that no indication had been given as to whether the purchase price would be altered or not, nor had it been learned how the proposed figure had been arrived at. The Oversman had said, however, that there would not be payment twice over for any assets. Treasurer Hilgour said that the whole management of the Gas Company should be taken into consideration, as the undertaking could not be carried on on the same lines as in the past; and he suggested that the administration of the Gas Department should be considered at a joint meeting of the Gas Committee and the Finance Committee, who should report to the Council before any further steps were taken. This was agreed to.

At a meeting of the Brechin Town Council on Wednesday, Treasurer Archibald moved that a Committee be appointed to inquire and report upon the necessary steps for the taking over of the gas-works, and also upon the financial arrangements required for the purpose. He said the gas-works would be a source of revenue to them. Dean of Guild Moir thought that before appointing a Committee they should first have an expression of opinion as to whether they should take over the works or not. He moved the previous question. This was not seconded; and the motion was then adopted, and a Committee appointed.

The Corporation of Kirkintilloch have not yet got free of trouble upon the subject of the working out of coal from beneath the gas-works. They have been negotiating with the Woodilee Coal Company upon it for some time. At a meeting of the Town Council on Tuesday, it was moved that £2000 be borrowed, to pay for the acquisition of the whole of the minerals above the coking coal. This was agreed to.

Messrs. R. & A. Main have been successful in securing, in open competition, the gas-cooker contract for Barrow-in-Furness.

We cordially invite you to write to our Hot-Water Consultative Department, 21, Queen Victoria Street, London, E.C., on any Hot-Water problem.

The fullest expert advice is most freely at your disposal.

JOHN WRIGHT & CO.,
21, Queen Victoria St.,
LONDON, E.C.

272.

CURRENT SALES OF GAS PRODUCTS.

[For Table of "Tar Products Prices," see p. 190.]

Sulphate of Ammonia. LIVERPOOL, *April* 13.

Since the end of last week there has been very little change in the aspect of the market; the tone continuing quiet, and quotations remaining practically without alteration. A certain amount of demand has come forward for early delivery; but inquiry for supplies beyond the next week or two is limited. The nearest values to-day are £13 12s. 6d. to £13 13s. 9d. per ton f.o.b. Hull, £13 13s. 9d. to £13 15s. per ton f.o.b. Liverpool, and £13 16s. 3d. to £13 17s. 6d. per ton f.o.b. Leith. No further first-hand transactions for future delivery have been reported; but it is said dealers are offering May-June at £13 10s., and July-December at £13 7s. 6d. per ton, f.o.b. at principal ports.

Nitrate of Soda.

The market for this article is rather slow, but holders are firm at 9s. 9d. per cwt. for 95 per cent. and 10s. for 96 per cent. quality on spot.

LONDON, *April* 13.

Tar Products.

The markets for tar products remain steady. There has been a slight improvement in pitch, and makers are now very firm in their ideas of value. There is no change in benzols. Creosote is steady, and there are a few more orders in the market. Solvent naphtha is quiet; but the inquiry for heavy naphtha is better. Crude carbolic is unchanged, and business is very difficult to negotiate.

The average values during the week were: Tar, 17s. 9d. to 21s. 9d., *ex* works. Pitch, London, 36s. to 36s. 6d.; east coast, 35s. 6d. to 36s.; west coast, Manchester, 35s. 6d. to 36s., Liverpool, 36s. to 36s. 6d., Clyde, 36s. to 36s. 6d. Benzol, 90 per cent., casks included, London, 8¾d. to 9¼d.; North, 8½d. to 9d.; 50-90 per cent., casks included, London, 9d. to 9½d.; North, 8½d. to 9d. Toluol, casks included, London, 9¾d.; North, 9¼d. to 9½d. Crude naphtha, in bulk, London, 4d. to 4½d.; North, 3¼d. to 3½d.; solvent naphtha, casks included, London, 11½d. to 1s.; North, 10½d. to 11d.; heavy naphtha, casks included, London, 1s. to 1s. 0½d.; North, 11d. to 11½d. Creosote, in bulk, London, 2¼d. to 2⅜d.; North, 1⅞d. to 2d. Heavy oils, in bulk, 2⅜d. to 2¾d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 7d. to 1s. 8d.; west coast, 1s. 6½d. to 1s. 7½d. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 42s. 6d., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

The market for this article is decidedly quiet, and prices have declined still further. Outside London makes, 25 per cent., are quoted at £13 1s. 3d. to £13 2s. 6d.; Hull, £13 15s.; Liverpool, £13 15s.; Leith, £13 17s. 6d.; and Middlesbrough, £13 13s. 9d. to £13 15s.

COAL TRADE REPORTS.

Northern Coal Trade.

The coal trade has been very active for the last few days. There has been a desire to get cargoes away before the holidays; and thus the large output of coal has been well taken up. In the steam coal trade, best Northumbrians are firm at from 10s. 9d. to 10s. 10½d. per ton f.o.b., second-class steams are 9s., and steam smalls from 5s. to 6s. 3d. For loading after the holidays, some of the prices seem to be a little easier; but for the next few days there may be, with the reduced output, some scarcity that tends to keep up the prices. In the gas coal trade, the demand seems slightly stronger, as the lessened shipments for the next few days will allow the stocks to be reduced; and, in consequence, the prices appear to be firmer. Durham gas coals are from 8s. 9d. to 9s. 6d. per ton f.o.b. for the usual classes, according to the quality; while for "Wear" specials, from 10s. 6d. to 10s. 10d. a ton is now quoted. The local consumption of gas coals is decreasing, but more is being shipped to some of the foreign buyers. There is little to say as to contracts; but sales of cargoes for forward delivery are being made at something like the current prices above quoted. In coke, the market is firmer. Good gas coke is quoted from 13s. to 13s. 3d. per ton f.o.b. in the Tyne or the Wear.

Scotch Coal Trade.

There is still complaint of want of demand to take up fully the output from the pits. Since the year began, prices generally have receded by about 1s. per ton, and the shrinkage in demand is apparent from the figures relating to shipping. These show shipments for the week amounting to 304,241 tons—an increase of 6916 tons upon the previous week, but a decrease of 15,292 tons upon the corresponding week last year. For the year to date, the total shipments have been 3,904,396 tons—a decrease upon the corresponding period of 178,608 tons. The prices now quoted are: Ell, 8s. 6d. to 8s. 9d. per ton f.o.b. Glasgow; splint, 9s. 6d. to 9s. 9d.; and steam, 8s. 9d. to 9s.

Gas Profits in Aid of Rates at Manchester.—Pressure is being brought to bear upon the Gas Committee of the Manchester Corporation to contribute this year, as last, £50,000 out of profits in relief of the rates, in which case the Finance Committee hope to be able to avoid any increase in the city rate for the ensuing twelve months. Of course, it is anticipated that the other trading departments of the Corporation will contribute a similar amount to that of last year. So far, it appears that the increased demands made by certain spending Committees are to some extent counterbalanced by the lessened calls from other departments; the net advance on last year's estimates being about £6000. This represents a little less than one-third of a penny in the pound. An effort is to be made to squeeze a little more out of the profit-earning departments, which, if successful, will result most likely in a slight reduction in the city rate.

THE BOOK OF THE SEASON.

CONCERNING GAS COOKING.

This booklet gives a selection of the most popular "MAIN" lines in Gas Cookers, Grillers, Boiling Rings, Boiling Plates, Baking Plates, Laundry Iron Heaters, Water Heaters, &c. Concise, yet sufficiently comprehensive. Got up in the usual artistic style of the "MAIN" publications, it is sure to be appreciated.

SUPPLIES ON APPLICATION.

R. & A. MAIN, LIMITED,

WORKS: Gothic Works, EDMONTON, N.; and Gothic Ironworks, FALKIRK.
SHOW-ROOMS: 25, Princes St., Oxford Circus, W.; 136, Renfield St., GLASGOW; 56, Broad St., BIRMINGHAM; 83, Old Market St., BRISTOL; 13, Whitworth St. West, MANCHESTER; and 333, Queen St., MELBOURNE.

Salford Gas Charges.

As reported in recent issues of the "JOURNAL," meetings of ratepayers in Salford and the district have been held at which resolutions were passed protesting against the charges made by the Corporation for gas, and calling upon the Mayor to convene a town's meeting to consider the whole question of the management of the gas undertaking. Certain members of the Town Council favour the holding of an inquiry to be conducted by some outside expert authority to be approved by the Council. Alderman Phillips, the Mayor, who is Chairman of the Gas Committee, has given his answer very plainly. He says: "There has been no resolution submitted to the Gas Committee calling for an investigation during the past twelve months, as suggested in some quarters. As to whether the Committee are prepared to grant every facility for a full and impartial inquiry, I have told the Council at all times, as I tell them now—certainly, inquire as fully as you like into everything you like, and whenever you like, and you shall have all the help I can give you. But I should certainly say, so far as I understand the situation, that the whole matter appears to be a question of policy. That policy has been settled by the Town Council, and not by the Gas Committee. The Gas Committee will bear their own sins; but they must not be asked to bear the sins of the Council, if they be sins, in respect of their policy in regard to the amount to be directed to the rates. The question of investigation by an expert authority is one which does not concern me as Chairman of the Gas Committee, but the Council."

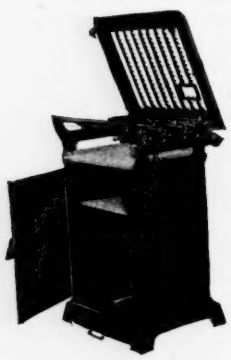
Worksop Water Supply.—The Water Committee of the Worksop Urban District Council have been authorized to negotiate a loan of £70,000 required in June for the purchase of the local water-works.

Bacup's Costly Water-Works Scheme.—The Water Committee of the Bacup Corporation have decided to apply to the Local Government Board for power to borrow an additional £22,000 for the water scheme. Against the £190,000 already borrowed, there has been an expenditure of £211,523. The matter was mentioned at a recent meeting of the Town Council; and Alderman J. C. Hoyle entered into a long explanation. He said the cost of the water-works and the land up to now was £187,363; easements, £693; and mains, £23,467—making a total of £211,523. Their borrowing powers were £190,000; so that there was a balance of £21,523 on the wrong side. There were certain unspent balances on other items; but they were included in the Act for specific purposes, and could not be utilized for the Cowpe undertaking. Consequently they had to go to the Local Government Board for £22,000 in order to be set straight. He admitted that unless the sources of revenue could be substantially increased the rates were bound to go up in the near future. The salvation of the borough in regard to keeping the rates at their present level could be secured by selling water from the Cowpe reservoir to an outside authority. After discussion, the Council agreed to the additional borrowing powers.

Sutton-in-Ashfield Council and Colliery Gas.—The Gas Committee have reported to the Sutton-in-Ashfield Urban District Council that Mr. S. Watson, the General Manager of the New Hucknall Colliery Company, had attended a meeting, when terms for the purchase of gas from the Colliery Company were discussed; and it was arranged to ask the Directors of the Company what the lowest price would be at which they could sell gas, on condition (1) that the Colliery Company should supply the main, and (2) that the main should be supplied by the Council.

Tarapaca Water-Works Company, Limited.—The annual general meeting of this Company was held at Winchester House, E.C., on Monday last week—Sir Robert Harvey, M.Inst.C.E., presiding. In moving the adoption of the report, noticed in the "JOURNAL" for the 4th inst. (p. 64), the Chairman said the results of the past year's working, so far as regarded profit and loss, were, by a strange coincidence, almost identical with those shown in the previous year's accounts; the net profit, after all deductions, being £51,864, against £51,993 this time last year—a difference as between the two years of only £129. The Directors were paying 8 per cent., in place of 7½ per cent. paid for some years; and in addition they were glad to be able to place to the reserve fund a further £25, making it up to £65,000. This reserve was being built up for the purpose of effecting a further reduction of capital; and it was practically represented by actual cash in hand and investments, the amount of which was £71,247. He was glad to say they were getting appreciably nearer to being able to reduce the capital by a further £80,000. The report was adopted.

Gas Lighting of East Stonehouse.—A meeting of the East Stonehouse District Council was held on Tuesday last, when the Works Committee recommended that a contract be entered into with the Plymouth and Stonehouse Gas Company for the lighting of the streets with gas for seven years. Mr. H. E. James opposed the recommendation, and said it was a retrograde step to light the main thoroughfare by the old system of gas. Mr. H. O. Husband contended that the tests had not been carried out in a fair and business-like manner. The Gas Company had held an unfair advantage, and he understood there would be a loss of £100 by the adoption of their tender. He moved, as an amendment, that the contract be divided, and that district No. 1 be lit with electricity and No. 2 with gas. Mr. J. W. Foster denied that the tenders had been treated in an unfair or unbusinesslike manner. The Works Committee had given the matter prolonged and serious consideration, and their recommendation, which would mean a saving of £100 a year, was based on the report of the Surveyor. The amendment was defeated, and the Committee's recommendations were approved. Under the new contract, there will be placed in the streets 17 lamps of 225-candle power, the charge for which will be £9 5s. 6d. per annum; 18 of 150-candle power, at £5 15s. 6d. per lamp; and 171 of 75-candle power, at £3 10s. per lamp. The total charge amounts to £860 2s. 6d., less £30 rebate on mantles; making the net cost £830 2s. 6d. per annum.



The Long-Life

COOKER.

THE following unsolicited eulogium has just come to hand, and speaks for itself:

"For more than 25 years I have used constantly one of your Gas Stoves, and during that period it has given every satisfaction. Once only in the 25 years has it needed your attention. I think this fact is a proof of the durability and superior manufacture of your stoves."

WHAT more practical confirmation could be found of our claim that nothing can surpass our manufactures on the score of

MAINTENANCE.

The Davis Gas Stove Co., Ltd., Luton.

London Show-Rooms:

59, Queen Victoria Street, E.C.

('Phone: 742 Bank.)

Buenos Ayres Water-Works.—It is reported that contracts amounting to £400,000 have been signed in London for the construction and equipment of the water-works at Buenos Ayres with new pumping machinery; and that Messrs. Simpson have secured the greater portion of the work at £218,000.

Bakewell Water Supply.—The Local Government Board have sanctioned a loan by the Bakewell Urban District Council of £1500 for water-works for Grindleford Bridge and Eyan Woodlands. The works comprise the construction of a storage reservoir, the laying of water-mains, &c. The scheme has been prepared by Messrs. Brady and Partington, of Chapel-en-le-Frith.

Monmouthshire Water Supply.—The work of sinking the trial holes on the Grwynne Fawr site of the water-works to be constructed for the Western Valleys Water Board in the Breconshire mountains has been commenced. Messrs. Underwood Bros., of Dukinfield, are the Contractors, and it is expected that they will in a few weeks complete the boring of the eight holes. Tenders will then be invited for the construction of the main works, which will be divided into two parts—the first for the construction of a road to the dam; and the second for mains and one storage-tank for 4 million gallons and two others for 3 million gallons each.

Kensington Public Lighting.—The Kensington Borough Council have decided, in connection with the scheme recently adopted by them for the improvement of the public gas lighting of the borough, to obtain 13 improved hexagon (Kensington pattern) lamps from Messrs. D. Anderson and Co., 20 "arc" type lamps from Messrs. Falk, Stadelmann, and Co., and a like number from Messrs. William Sugg and Co. The first-named firm are to convert 70 Kensington pattern lamps for use with two inverted incandescent burners, and 500 such lamps for use with one inverted incandescent burner. The total cost of the foregoing changes is estimated at £611.

Quality of Gas at Walsall.—When discussing in the Walsall Town Council the report of the Gas Committee, Alderman Pearman Smith said one paragraph stated that inquiries made showed there was no sufficient ground for the complaints urged at a previous Council meeting with regard to the quality and purity of the gas. He moved an amendment disapproving of this portion of the report, and instructing the Committee to obtain a report from an independent gas engineer on the subject. He expressed the opinion that the statement made in the report was untrue, and that this would be the opinion of the majority of the Council. Mr. Venables defended the Committee, and read a long report with a view of showing that any difficulties were due to defective fittings. Mr. Ingram remarked that the report simply made the Committee look ridiculous; and Alderman Hughes added that it was obviously a partisan report to shield the department. The Town Clerk intimated that the Committee had no objection to an independent test of the gas taking place; and the amendment was agreed to.

The Tollesbury and District Gas Company, Limited, has been registered with a capital of £4000, in £1 shares.

The Ryde (Isle of Wight) Corporation have renewed their tender with the Gas Company for lighting the town for a further period of three years.

The Local Government Board have sanctioned the borrowing by the Finchley District Council of the sum of £15,410 for the extension of the electric light undertaking, the capital account of which is already over £100,000. The consumers number only 2419.

At an extraordinary general meeting of the Mazza Centrifugal Gas Syndicate, Limited, held recently, a resolution was passed to the effect that the Company be wound up voluntarily. Mr. Oliver E. Yeo, of No. 19, Great Winchester Street, E.C., was appointed Liquidator.

In the Court of Appeal on Monday last week, the matter of the British Cerofirm Company, Limited, was in the list for hearing, upon the appeal of Mr. H. Sanguinetti from an order of Mr. Justice Neville. Counsel stated that the case had been settled, and the appeal, by leave, would be withdrawn. Their Lordships granted the application.

The report of the Kimberley Water-Works Company for the year ended Dec. 31 last shows a profit of £24,894. The Directors propose to write off £5605 from construction, to transfer £1391 to the investment fluctuation reserve, and to pay a dividend of 2½ per cent. for the six months to Dec. 31, making a total of 5 per cent. for the year, and absorbing £15,750.

The Bridlington Gas Company, in conjunction with the Richmond Gas Stove and Meter Company, Limited, have been demonstrating with marked success to the consumers of Bridlington the advantages of gas cooking and heating. A large number of orders were taken through the medium of a comprehensive exhibition and a thorough canvass of every consumer not at present using a gas-cooker.

"Concerning Gas Cooking" is the title of a new booklet which Messrs. R. & A. Main, Limited, have brought out for the summer season. It contains a selection of their most popular lines in gas cookers, grillers, boiling rings, water-heaters, &c. The booklet is comprehensive, yet concise; and it is got up in an artistic style. Messrs. Main will forward copies on application.

The Lead Wool Company, Limited, were recently opposed when desiring to register the words "Lead Wool" as a trade mark; and the matter was eventually referred to the Board of Trade. Affidavits in support of the application were called for, and duly filed; and the Company have now been notified by the Board that their application has been acceded to, and will be proceeded with in the usual manner.

The tender of Messrs. Willey and Co., Limited, of Exeter, has been accepted by the Boston Gas Company for the erection of a new two-lift gasholder and the removel of the existing single-lift holder, which the new one replaces. The Ebbw Vale Steel and Iron Company have accepted their tender for the supply and erection of four purifiers fitted with their patent Pickering valve; and the Directors of the Blackwood Gas Company one submitted for the supply and erection of six ⌂ retorts with furnace fittings, cast-iron scrubber, with valves and connections, four purifiers, fitted with Pickering patent valves, cast-iron tar-tank, and station meter and governor.

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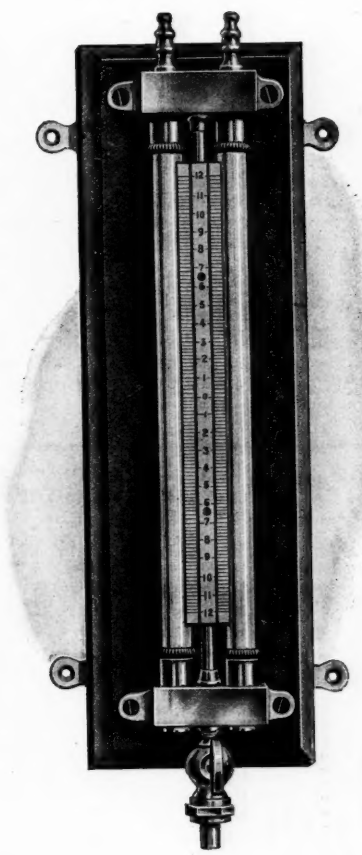

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WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

MANAGER. Brecon Gas Company.
TRAVELLER. No. 5361.
CANVASSERS. 5382.

Situation, &c., Wanted.

SULPHATE PLANT REPAIRER, &c. Davies, Shepherd's Bush.

Plant, &c. (Second-Hand), For Sale.

STATION METER. Clitheroe Gas Department. Tenders by April 22.
HIGH PRESSURE LIGHTING PLANT. Hereford Gas Works.
PURIFIERS, &c. R. & J. Dempster, Limited, Manchester.
ROVER CAR. South Bank Gas Works.

Stocks and Shares.

ASCOT DISTRICT GAS AND ELECTRICITY COMPANY. By Auction. April 25.
CHERTSEY GAS COMPANY. By Auction. April 25.
LIMPSFIELD AND OXTED WATER COMPANY. By Auction. April 25.
MERTHYR TYDFIL GAS COMPANY. By Tender. May 11.
SOUTH ESSEX WATER COMPANY. By Auction. April 25.
SOUTHEND WATER-WORKS COMPANY. By Auction. May 9.
SOUTHGATE GAS COMPANY. By Auction. May 9.
WHITCHURCH AND DISTRICT GAS COMPANY. By Auction. April 25.

TENDERS FOR

Coal and Cannel.

BARNOLDSWICK URBAN DISTRICT COUNCIL. Tenders by May 1.
BARROW-IN-FURNESS CORPORATION. Tenders by May 2.
DENBIGH GAS AND WATER COMPANY. Tenders by April 27.
DEVONPORT GAS DEPARTMENT. Tenders by May 6.
DROITWICH GAS DEPARTMENT. Tenders by April 28.
EASTBOURNE GAS COMPANY. Tenders by May 2.
LLANDUDNO URBAN DISTRICT COUNCIL. Tenders by April 29.
LOUTH GASLIGHT COMPANY. Tenders by April 25.
SHREWSBURY GASLIGHT COMPANY. Tenders by April 21.
TORQUAY GAS-WORKS COMMITTEE. Tenders by April 24.

Meter Station.

CLITHEROE GAS DEPARTMENT. Tenders by April 22.

Purifiers, &c.

CLITHEROE GAS DEPARTMENT. Tenders by April 22.

TAR PRODUCTS PRICES.

Representative manufacturers give the following as fair current values for the week ending April 15. Prices are net, and they include the usual packages and delivery f.o.b., f.a.s., or f.o.r., as customary.

Article.	Basis.	London.	North-East Coast.	East Coast, Yorks.	West Coast.		Glasgow.
					Liverpool.	Manchester.	
Tar crude	per ton	—	18/9 21/6	18/6 22/-	19/- 20/9	18/9 20/9	—
Pitch	,,	37/-	35/6 36/-	35/9	37/-	35/9 36/-	35/6
Benzol, 90%	per gallon	-/10	-/9	-/9	-/9	-/9	-/9
Benzol, 50-90%	,,	-/10½	-/9¼ -/9½	-/9½	-/8⅝	-/8½	—
Toluol, 90%	,,	-/10	-/9¾	-/10	-/10	-/10	-/10
Crude naphtha, 30%	,,	—	-/3¾	-/4	-/3½	-/3½	—
Light oil, 50%	,,	—	-/3½	-/3¾ -/4	-/3 -/3⅛	-/3⅜	—
Solvent naphtha, 90-160	,,	—	-/10½ -/11	-/10	-/10	-/10½	-/11
Heavy naphtha, 90-190	,,	—	-/11	-/11½	-/11	-/11¼	-/11
Creosote in bulk	,,	-/2½ -/2⅝	-/2⅛	-/2	-/2⅛	-/2⅛	-/1⅞
Heavy oils	,,	—	-/2⅜	-/2¼	-/2⅜	-/2⅝ -/2⅝	-/2⅜
Carbolic Acid, 60's	,,	—	1/7½	1/7	1/7	1/7½ 1/8	1/8½
Naphthalene, crude drained salts	per ton	—	42/6 45/-	40/- 42/6	45/-	47/6	—
,, pressed	,,	—	60/-	63/-	58/9	60/- 72/6	—
,, whizzed	,,	—	—	—	71/3	62/6 75/-	63/-
Anthracene	per unit	-/2	-/1⅜	-/1½	-/1¼	-/1¼	—

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 160.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Apl. 12	5	Alliance & Dublin Ord.	81—84*	..	5 19 1
374,000	Stk.	Jan. 13	4	Do. 4 p.c. Deb.	95—97	..	4 2 6
200,000	5	Oct. 28	7	Bombay, Ltd.	6¾—7	..	5 0 0
40,000	5	,,	7	Do. New, £4 paid	5¼—5⅜	..	4 17 5
50,000	10	Feb. 24	15	Bourne- mouth Gas & Water B 10 p.c.	28—29	..	5 3 5
311,810	10	,,	7	Bourne- mouth Gas & Water B 7 p.c.	16—16½	..	4 4 10
75,000	10	,,	6	Bourne- mouth Gas & Water Pref. 6 p.c.	14½—15	..	4 0 0
380,000	Stk.	,,	12½	Brentford Consolidated	254—257	+2	4 18 3
330,000	,,	,,	9½	Do. New	197—200	..	4 15 0
50,000	,,	,,	5	Do. 5 p.c. Pref.	122—124	..	4 0 8
206,250	,,	Dec. 15	4	Do. 4 p.c. Deb.	98—100	..	4 0 0
220,000	Stk.	Mar. 10	11	Brighton & Hove Orig.	215—218	..	5 0 11
246,320	,,	,,	8	Do. A Ord. Stk.	155—158	..	5 1 3
460,000	20	Apl. 12	10⅝	British	43¾—44½*	..	4 15 4
120,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb. Stk.	96—98	..	4 1 8
109,000	,,	Feb. 10	6	Bromley, A 5 p.c.	116—118	..	5 1 8
165,700	,,	,,	4½	Do. B 3½ p.c.	87—89	..	5 1 2
82,278	,,	,,	5½	Do. C 5 p.c.	106—108	..	5 1 10
55,000	,,	Dec. 30	3½	Do. 3½ p.c. Deb.	84—86	..	4 1 5
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	96—98	..	4 1 8
100,000	10	—	—	Cape Town & Dis., Ltd.	3¾—4¼	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	6—6⅝	..	—
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	—	..	—
100,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	88—90	..	5 0 0
157,150	Stk.	Feb. 24	5	Chester 5 p.c. Ord.	109—111	..	4 10 1
1,513,280	Stk.	,,	5/9/4	Commercial 4 p.c. Stk.	113—116	..	4 14 3
560,000	,,	,,	5½	Do. 3½ p.c. do.	108—110	..	4 16 11
475,000	,,	Dec. 15	3	Do. 3 p.c. Deb. Stk.	77—79	..	3 15 11
800,000	Stk.	,,	4	Continental Union, Ltd.	95—97	..	4 2 6
200,000	,,	,,	7	Do. 7 p.c. Pref.	136—138	..	5 1 5
492,270	Stk.	—	5½	Derby Con. Stk.	132—124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk.	104—105	..	3 16 2
148,995	,,	Apl. 12	5	East Hull 5 p.c. Ord.	101—103*	+½	4 17 1
840,150	10	Jan. 27	10	European, Ltd.	19½—20½	..	4 17 7
16,179,445	Stk.	Feb. 24	4⅜	Gas-light and Coke 4 p.c. Ord.	105½—106½	..	4 7 7
2,600,000	,,	,,	3½	Gas-light and Coke 3½ p.c. max.	85—87	..	4 0 6
4,062,235	,,	,,	4	Gas-light and Coke 4 p.c. Con. Pref.	101—103	..	3 17 8
4,531,705	,,	Dec. 15	3	Gas-light and Coke 3 p.c. Con. Deb.	79—81	..	3 14 1
258,740	Stk.	Mar. 10	5	Hastings & St. L. 3½ p.c.	92—94	..	5 6 5
82,500	,,	,,	6½	Do. do. 5 p.c.	—	..	—
70,000	10	Oct. 14	11	Hongkong & China, Ltd.	17½—18	..	6 2 3
131,000	Stk.	Mar. 10	7⅜	Ilford A and C	143—146	..	5 1 0
65,780	,,	,,	5⅛	Do. B	113—115	..	5 2 2
65,500	,,	Dec. 30	4	Do. 4 p.c. Deb.	96—98	..	4 1 8

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
4,940,000	Stk.	Nov. 11	9	Imperial Continental	191—193	..	4 13 3
1,235,000	Stk.	Feb. 10	3½	Do. 3½ p.c. Deb. Red.	92—94	..	3 14 6
200,242	Stk.	Mar. 10	6	Lea Bridge Ord. 5 p.c.	119—121	..	4 19 2
561,000	Stk.	Feb. 24	10	Liverpool United A.	214—216	..	4 12 7
718,100	,,	,,	7	Do. B.	161½—163½	..	4 5 8
306,083	,,	Dec. 30	4	Do. Deb. Stk.	102½—104½	..	3 16 7
75,000	5	Dec. 15	6	Malta & Mediterranean	4¾—5	..	6 0 0
560,000	100	Apl. 1	5	Met. of 5 p.c. Deb.	100—102	..	4 18 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	Nov. 11	3½	Monte Video, Ltd.	13—13½	..	5 3 8
1,775,892	Stk.	Feb. 24	4⅜	Newc'tle&G'tesh'd Con.	100½—101½	..	4 6 2
529,705	Stk.	Dec. 30	3½	Do. 3½ p.c. Deb.	89—90	..	3 17 9
55,940	10	Mar. 10	7	North Middlesex 7 p.c.	14½—15½	..	4 10 4
300,000	Stk.	Nov. 30	8	Oriental, Ltd.	139—141	..	5 13 6
60,000	5	Apl. 12	8	Ottoman, Ltd.	6¾—7¼*	..	5 10 4
31,800	53	Feb. 24	13	Portsea Island A	135—140	..	4 18 4
60,000	50	,,	13	Do. B	125—130	..	5 0 0
100,000	50	,,	12	Do. C	120—125	..	4 16 0
114,800	50	,,	10	Do. D and E.	102—105	..	4 15 3
398,490	5	Oct. 28	7	Primitiva Ord.	7¾—8	..	4 7 6
796,980	5	Dec. 30	5	Do. 5 p.c. Pref.	5¾—5⅞	..	4 10 11
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
312,650	Stk.	Dec. 30	4	River Plate 4 p.c. Deb.	96—98	..	4 1 8
250,000	10	Mar. 24	9	San Paulo, Ltd.	15¾—16	..	5 12 6
115,000	10	,,	6	Do. 6 p.c. Pref.	11¾—12	..	5 0 0
125,000	50	Jan. 3	5	Do. 5 p.c. Deb.	50—51	..	4 18 0
135,000	Stk.	Mar. 24	10	Sheffield A	234—236	..	4 4 9
209,984	,,	,,	10	Do. B	234—236	..	4 4 9
523,500	,,	,,	10	Do. C	234—236	..	4 4 9
70,000	10	Oct. 14	6	South African	10¾—11	..	5 9 1
6,429,895	Stk.	Feb. 10	5/9/4	South Met., 4 p.c. Ord.	119—121	..	4 10 3
1,895,445	,,	Jan. 13	3	Do. 3 p.c. Deb.	79—81	..	3 14 1
209,820	Stk.	Mar. 10	8	South Shields Con. Stk.	153—155	..	5 3 3
605,000	Stk.	Feb. 24	5⅜	S'th Suburb'n Ord. 5 p.c.	119—121	..	4 13 6
60,000	,,	,,	5	Do. 5 p.c. Pref.	118—120	..	4 3 4
117,058	,,	Jan. 13	5	Do. 5 p.c. Deb. Stk.	122—124	..	4 0 8
502,310	Stk.	Nov. 11	5	Southampton Ord.	111—113	..	4 8 6
120,000	Stk.	Feb. 10	7	Tottenham and Edmonton A 5 p.c.	141—143	..	4 17 11
483,940	,,	,,	5⅛	Tottenham and Edmonton B 3½ p.c.	115—117	..	4 14 0
149,470	,,	Dec. 15	4	Tottenham and Edmonton 4 p.c. Deb.	98—100	..	4 0 0
182,380	10	Dec. 30	8	Tuscan, Ltd.	9—9½	..	8 8 6
149,900	10	Jan. 3	5	Do. 5 p.c. Deb. Red.	98—100	..	5 0 0
236,476	Stk.	Feb. 24	5	Tynemouth, 5 p.c. max.	112—113	..	4 8 6
255,636	Stk.	Feb. 24	6¾	Wands-worth B 3½ p.c.	141—143	..	4 14 5
85,766	,,	Dec. 30	3	Wands-worth 3 p.c. Deb. Stk.	73—75	..	4 0 0

Prices marked * are "Ex. div."